ARITHMETIQUE
Made easie,

THE SECOND BOOK:

Containing a perfect method for the true knowledge, and practice of ARTIFICIALL ARITHMETIQUE performed by LOGARITHMS:

And resolving all Arithmeticall Questions by *Addition* and *Subtraction*.

Together with the Construction and use of an Instrument called THE LINE OF PROPORTION, exhibiting the *Logarithm* of any number under 100000.

Unto which is also annexed an APPENDIX resolving likewise by *Addition* and *Subtraction* all Questions, that concern *Equation* of Time, *Interest* of Money, and *valuation* of Purchases, Leases, Annuities, and the like.

By EDM. WINGATE, *Esquire*.

The second *Edition*, diligently corrected, and much inlarged by the *Author* himselfe.

Frustrà fit per plura, quod fieri potest per

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THE PREFACE.

ARithmetique needs not the *Logicians* arguments, nor the *Rhetoricians* Eloquence to prove or perſwade the uſefulnes thereof to the *World*, every mans particular *occaſion*, to uſe it, is ſufficient to ſatisfie any man in that *point*: Howbeit, moſt men deſpaire to attain the knowledge thereof, partly becauſe the *Treatiſes* which teach it, are for the moſt part (for want of *Method*) both tedious and obſcure, partly becauſe moſt of the *Operations* of that *Art* are taught in former *Authors* to be performed by (two too intricate branches of *Arithmetique*) *Multiplication* and *Diviſion*, which ſo confound and perplex the new *Practitioner*, that he takes them to be *Hercules*

Neper Rabdolog. in fine Epiſt. dedic.

Pillars, and writes upon them *Non plus ultra*.

This I premiſe, not that I would ſeem wiſer then *my Teachers*; neither yet do I aſſume, that I only have kept the *right* path, and their ſteps have been *erronious*: but this I avouch, that the *operations*, which they work by *Multiplication* and *Diviſion*, I perform (in this Book) by *Addition* and *Subtraction*; likewiſe their *Extraction* of the *Square-root* by *Bipartition*, or *Diviſion* by *two*; and their *Extraction* of the *Cube-root* by *Tripartition*, or *Diviſion* by *three*: So that I confidently averre (with *John Neper*, late *Baron* of *Merchiſton* in *Scotland*, now deceaſed) that *this way* a man may reſolve more queſtions in an *houre*, then following the *former courſe*, he ſhall be able to reſolve in a *whole day*. Nevertheleſſe, this that I here preſent to publique view, is but a *borrowed light*, which I (as a *Star* of the leaſt *Magnitude*) take from theſe two great *Luminaries*, the ſaid late *Baron* of *Merchiſton*, and Mr. *Henry Brigges*, late *Profeſſor* of *Geometry* in the famous Univerſity of *Oxford* (now alſo deceaſed,) who by this time have enlightened al *Europe* with the rare and exquiſite *invention* of the *Logarithms*.

Neper Mirif. Logar Can. deſcip. in Epiſ. Dedic.

For

For the *first* of these renowned *Authors*, finding the *vulgar way* of working *Arithmeticall Operations* (by reason of *Multiplication*, *Division*, and the *Extraction of Roots*) not only extream tedious, and troublesome; bnt likewise (in regard of the intricatenesse thereof) very subject to many mistakes and *Errors*, endeavoured to invent some apt *Compendiums*, by which their tediousnesse and prolixity might be abridged: He therefore among many other laudable *Inventions* of that kinde, at last fell upon *this* of the *Logarithmes*, without question of all others the fittest, and most expedite. And hereupon in *Anno* 1614 he published a Book intitled *Mirifici Logarithmorum Canonis descriptio*, in which he gave direction how to resolve all the *Propositions* of *Trigonometry*, by *Addition* and *Subtraction*, which were never performed before without *Multiplication* and *Division*; And besides, by the same *Book* he gave such a *light* of the usefulnesse of *that way*, unto the *Mathematicians* of those times, that every man was ready to imbrace it, as a new found *treasure*, and to have both the *Invention* and the *Author* thereof in high esteem.

Nepor. ibid. in Præfat.

See his *Rabdologia. &c.*

Among these, Mr. *Brigges* above mentioned, deserves the greatest commendation, who having explained, and highly extolled the same *Invention* in his ordinary *Lectures* at *Gresham-Colledge* in *London*, (where he was then resident,) as soon as his necessary *Imployments*, and the *season* of the yeare did permit, undertook a Journey into *Scotland*, upon purpose to have farther conference with that learned *Author* about that subject: And whereas the *Baron* of *Merchiston* in the *Calculation* of his *Canon* (published in the aforesaid Book) had supposed the *Logarithm* of the *Radius*, or *Totall Sine* to be 000000, &c. and so the *Logarithms* of the other *Sines* to increase down-wards *ad infinitum*; upon conference had betwixt them, it was conceived most convenient, that 000000, &c. should be appointed the *Logarithm* of 1, and 1000000, &c. the *Logarithm* of the *Radius*: For thus Mr. *Brigges* speaks of that conference and resolution. *Cùm ego meis auditoribus Londini publicè in Collegio Greshamensi horum* (Logarithmorum scilicet) *Doctrinam explicarem; animadverti multo futurum commodius, si Logarithmus Sinûs totius*

Briggius in Præfatione ad Arith. Log.

totius ſervaretur 0 (*ut in Canone Mirifico*) *Logarithmus autem partis decimæ ejuſdem Sinûs totius, nempe,* 5 *grad.* 44 *minu.* 21 *ſecun. eſſet* 1000000, *&c. Atque ea de re ſcripſi ſtatim ad ipſum Authorem, & quàm primùm per anni tempus, & vacationem à publico docendi munere licuit, profectus ſum Edinburgum; ubi humaniſſimè ab eo acceptus, hæſi per integrum menſem. Cùm autem inter nos de horum mutatione ſermo haberetur, ille ſe idem dudum ſenſiſſe, & cupiviſſe dicebat: verum tamen iſtos, quos jam paraverat, edendos curâſſe, donec alios, ſi per negotia, & valitudinem liceret, magìs commodos confeciſſet. Iſtam autem mutationem ità faciendam cenſebat, ut* 0 *eſſet Logarithmus unitatis, &* 1000000, *&c. Sinûs totius: quod ego longè commodiſſimum eſſe non potui non agnoſcere.* Upon this ground Mr. *Brigges* not long after ſet forth a *Table* of *Logarithms* (intitled *Chilias prima*) which comprehended the *Logarithms* of all *numbers* from 1 to 1000, but this

Table

Table was too ſtrict for ordinary uſe, being indeed only the *foundation*, or preparative of a *larger work*, which he likewiſe, not many years after, publiſhed under the *Title* of *Arithmetica Logarithmica*; in this laſt Book he preſented to the Publique *larger Tables*, comprehending firſt the *Logarithms* of all *Numbers* from 1 to 20000, and then the *Logarithms* of all *numbers* from 90000 to 100000, together with direction, how to diſcover the *Logarithms* of the *mean numbers* intercepted betwixt 20000, & 90000, as alſo the *Conſtruction* of the ſame *Tables*, and their admirable uſe for the reſolution of divers *Problems* in *Arithmetique* and *Geometry*.

Now by the firſt ten *Chiliads* of the *Logarithms*, thus ſet forth by M^r. *Brigges*, as aforeſaid, I have fabricated the *Inſtrument* hereafter called (in this Book) *The line of Proportion*: For finding by experience how admirable uſefull thoſe *Tables* might be, if they were reduced to a leſſe *bulke*, & by that means made not only more *portable*, but likewiſe of a much lighter *value* and *price*; after many thoughts ſpent upon that *ſubject*, at laſt I hapned upon *this way*, which, as I conceive, is the plaineſt & beſt that can be invented for abbreviating the

Tables

Tables of *Logarithms*: For, this *Inſtrument* is (as you ſee) contained in ten pages of this Volume; and as for the uſe thereof, you may diſcover thereupon at one view the *Logarithme* of any *number* whatſoever, when it ſufficeth to work by *Logarithms* of ſix places; but when a *Logarithm* being propounded, you deſire to know his *correſpondent number*, if then (I ſay) the number you look for, exceeds not 60000, this *Inſtrument* will diſcover it *indifferent well*, but if that *number* need not exceed 30000, it will give it *exactly*; However, if there ſhould happen any *failer* therein, it can be but in the laſt figure, which is not greatly materiall in moſt Queſtions that occurre: Hereupon I confidently affirm, that by it you may work *Multiplication*, *Diviſion*, the *Extraction* of *Roots*, the *Golden Rule direct* and *Inverſe*, *Single* and *Double*, the *Rule* of *Fellowſhip*, the *Rule* of *Alligation*, the *Rule* of *Falſe*, and all other *Arithmeticall Operations* whatſoever, only by *Addition* & *Subtraction*, when the *term required* happens not to exceed 60000, although the *terms propounded* be never ſo large. Amongſt wch conveniencies and many other that are found in this *Inſtrument*, the *infallibility*

of

of the *Impreſſion* is not the leaſt; for it being at firſt perfectly *Engraven*, there can be no *error* committed in *Printing* the copies thereof, whereas the *Tables* of *Logarithms* (printed at large in *figures*) are ſubject to many faults, either in the *Compoſing*, *Correcting*, or *Imprinting*, whatſoever care or circumſpection may be uſed to prevent the ſame. Nevertheleſſe, if any ſhall deſire to make uſe of a Table of *Logarithms*, rather then of this Inſtrument, I cannot addreſſe him to a better then that contracted by Mr. *N. Roe*, exhibiting the *Logarithms* to eight places, which may be ſometimes requiſite in queſtions of *Trigonometry*; alſo I do direct to that Table the rather, in regard that the ſame is very exactly corrected by the care of Mr. *R. Butler* deceaſed, whoſe integrity in that work I take this occaſion to mention.

And now becauſe the *uſe* of this *Inſtrument* cannot be well underſtood, unleſſe the *Geneſis* or *Fabrique* thereof be firſt explained; neither yet the *making* of it conceived, unleſſe we firſt ſhew how to calculate the *Tables* of *Logarithms*, by which it is framed: Again, becauſe the *nature*, and *calculation* of *Logarithms* cannot be

per-

perfectly understood without the knowledge of *Naturall* or *Vulgar Arithmetique* (for these depend one upon another by a necessary *Concatenation:*) Therefore in the *first Book* I have premised an absolute and methodicall discourse of *Naturall Arithmetique*, shewing (by *Rule* and *Example*) how to work all the branches of *Arithmetique* the *vulgar way* heretofore used, as well in *mixt numbers* and *fractions*, as in *whole numbers:* In which *Book* I have likewise inserted divers other *rules*, which may any way conduce to the better understanding of *Artificiall Arithmetique*, and the *Nature* of *Logarithms:* And now in this second *Book* I first explain what *Artificiall Arithmetique* and *Logarithms* are; then proceeding to the *Construction* of *Logarithms*, I shew how to frame a *Table* of *Logarithms*, and annex thereunto (for example sake) a Table containing the *Logarithms* of all *numbers* from 1 to 100. In the next place I declare the *Construction* of the aforesaid *Instrument* called *The Line of Proportion*, and having thus prepared the way, I shew the *use* of the same *Instrument* (and so by consequent the use of *Logarithms*) in *Multiplication*, *Division*, the *Extraction* of *Roots*,

Cube,

Cube, and *Square*; in the reſolution of divers *Propoſitions*, that concern *Proportionall numbers*; In the *Golden rule direct* and *inverſe*, *ſingle* and *double*; In the *rules* of *Plurall Proportion*; In the *rule* of *Fellowſhip ſingle* and *double*; In the *rule* of *Alligation*, *Mediall* and *Alternate*; In the *rule* of *Falſe*, both of *ſingle* and of *double Poſition*: And in the laſt place (by way of *Appendix*) I have alſo explained the uſe thereof in the reſolution of *Queſtions* that concern *Equation* of *Time*, *Intereſt* of *Money*, and *Valuation* of *Leaſes* or *Annuities*; annexing under each of theſe *Heads*, apt and familiar *Examples*, ſometimes more, ſometimes fewer, as I have thought convenient. Again, in regard *Fractionall Operations* are diſperſed throughout the whole body of *Arithmetique*, as the *blood* is ſcattered throughout all the parts and members of a *naturall Body*, ſo that there can be ſcarce a Queſtion propounded in *Arithmetique*, but either ſome of the *termes given*, or the *term required* is either a *Fraction*, *ſingle* or *compound*, or elſe a *mixt number*, & becauſe *Fractions*, as alſo their *Reduction* and *Operations*, do ordinarily much incumber, and diſcourage the new *beginner*: And without the Reduction of other

other Fractions to *Decimals*, this Inſtrument cannot be convenient or uſefull for *Arithmeticall Operations*, I have therefore alſo (in the firſt Book) declared the true nature of *Fractions*, as alſo their reduction to *Decimal Fractions*, by help whereof (together with the inſtructions delivered in this Treatiſe) the induſtrious Reader (I doubt not) will be well able to reſolve any *Queſtion* of *Arithmetick*, whatſoever, as well in *broken* & *mixt*, as in *whole* numbers, onely by *Addition* and *Subtraction*, except it be the *Extraction* of *Roots*, which is alſo performed by as eaſie a way, *viz.* by *Bipartition*, and *Tripartition*, as before is declared. But leſt I ſhould ſeem by this large *Preamble* to ſet the truth at ſale, I will here ceaſe to hold you any longer in *ſuſpenſe*, that by peruſing this inſuing *Tractate*, you may *really* underſtand, what I can here but *ſuperficially* (as in a *glaſſe*) repreſent unto your view.

THE

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ERRATA.

SUch hath been the exact care of the Printer, that the Faults of *importance* escaped in this *Impression*, are onely these five.

Page 36 *line* 20, *for* the next, *read* next the. *Page* 39 *line* 8, *for* therefore *read* the reason. *Page* 47 *line* 16, *for* Thousand, *read* Fraction part. *Page* 89 *line* 27, *for* 149, *read* 194. *Page* 148 *line* 23, *for* 80005208, *read* 0005208.

ARITHMETIQVE ARTIFICIALL.

Chap. 1.

The definition of Logarithmes.

I. *Having in the first part of this Treatise, discovered the nature, properties & use of Arithmetique Naturall, it now follows, that in this, Artificiall Arithmetique should be explained, which is performed by borrowed numbers, usually called Logarithmes.* In the former book, and namely by the definition of *Naturall Arithmetique*, you may observe, that the operations thereof are performed by the numbers *themselves*. But here we setting aside the numbers *themselves*, perform the same operations an easier way by

borrowed numbers, or numbers appropriate to the numbers *themselves*, which by the Inventor thereof are fitly called *Logarithmes*.

What Arithmeticall and Geometricall proportion is. *Vide supra l. 1. cap. 20.*

II. *Logarithmes are borrowed numbers, which differ amongst themselves by Arithmeticall proportion, as the numbers that borrow them differ by Geometricall proportion:* So in the first column of the insuing table the numbers *Geometrically* proportionall, being 1, 2, 4, 8, 16, 32, 64, 128, 256, 512, 1024, &c. you may assign unto them for borrowed numbers, or *Logarithmes*, the numbers subscribed under the letters *A*, *B*, *C*, *D*, or any other at pleasure, provided that the *Logarithmes* so assigned still differ amongst themselves by *Arithmeticall proportion*, as the numbers of the first column differ by *Geometricall proportion:* For example, In the column *C*, if you will appoint 5 to be the Logarithme of 1, 8 the Logarithme of 2, and 11 the Logarithme of 4, 14 must needs be the Logarithme of 8, the next *proportionall*, &c. for the numbers 5, 8, 11, & 14, differ amongst themselves by *Arithmeticall proportion*, as 1, 2, 4, and 8 (the proportionall numbers untowhich they are respectively assign'd) differ by *Geometricall proportion:* The same ob-

observation may be made of the *Logarithmes* placed in the columns *A*, *B*, & *D*, or of any other numbers, which you shall assign as *Logarithmes*, unto any ranke of numbers, which are *geometrically* proportionall; And these *Logarithmes* or borrowed numbers you may propound to increase, and to be continued *upwards*, as those of the columns A, B C, or otherwise to decrease and to be continued *downwards*, as those of the column D.

	A	B	C	D
1	1	5	5	35
2	2	6	8	32
4	3	7	11	29
8	4	8	14	26
16	5	9	17	23
32	6	10	20	20
64	7	11	23	17
128	8	12	26	14
256	9	13	29	11
512	10	14	32	8
1024	11	15	35	5
	L	L	L	L

Vide Briggii *Arithm. Log. cap. 1.*

III. *From hence it followes, that any four numbers Geometrically proportionall being propounded, the summe of the Logarithmes of the meane numbers, is equall to the summe of the Logarithmes of the extreams*: So the four *proportionall* numbers being 2, 8, 16, and 64, and the Logarithme of 2 in the column C, being 8, the Logarithme of 8, 14, the Logarithme of 16, 17, and the Logarithme of 64, 23, I say the *summe*

of 14, & 17, the Logarithmes of the *mean* numbers, is equall to the *ſumme* of 8, and 23, the Logarithmes of the *extream* numbers: This *propoſition* is proved by the 16 *rule* of the 20 Chapter of the 1 book, for 8, 14, 17, 23, being numbers that differ according to Arithmeticall proportion *interrupted*, by that *rule*, the ſumme of 14 and 17 is equall to the ſumme of 8 and 23, as appears by the *example* of the ſame rule.

Chap. 2.

The Tabular conſtruction of Logarithmes.

I. *OF Logarithmes conſider*, 1. *the Conſtruction*, 2. *the Uſe.*

II. *Their Conſtruction is either Tabular or Lineall.*

III. *The Tabular Conſtruction of Logarithmes conſiſts in framing a table of Logarithmes*; that is to ſay, a *Table*, which may contein the *Logarithmes* of all numbers from 1. to 1000. 10000. 100000. or to any farther extent, which ſhall be thought convenient.

IV. *To*

IV. *To frame a table of Logarithmes you must propound unto your self first of all a convenient rank of numbers geometrically proportionall from* 1, *and then assign unto them that kind of Logarithmes, which may be aptest for use in all Arithmeticall operations*, viz. *such as you find set down in the table following*

How to frame a Table of Logarithmes.

A	*B*
1	0. 00000
10	1. 00000
100	2. 00000
1000	3. 00000
10000	4. 00000
100000	5. 00000
1000000	6. 00000
10000000	7. 00000
Num. Pro.	*Their Log.*

Here in the Column A you have a rank of numbers *geometrically* proportionall from 1, and over against each number his proper *Logarithme* in the other column signed by the letter B, so the Logarithme of 1 is 0.00000, the Logarithme of 10 is 1.00000, the Logarithme of 100 is 2.00000, &c. And this kinde of Logarithmes, is indeed without all

contradiction the fitteſt to expedite all Arithmeticall operations, as both thoſe excellent Inventors of the Logarithmes (*viz. John Nepeir* Baron of *Merchiſton* and Mr. *Brigges*) did conclude upon conference had upon that queſtion.

Briggius in Præfat. ad Arithm. Log.

V. *The firſt figure of each Logarithme is called the Characteriſtique of the ſame Logarithme.* So in the premiſed Table the *Characteriſtique* of 0.00000 the Logarithme of 1 is 0, the *Charact.* of 1.00000, the Logarithme of 10 is 1, the *Charact* of 2.00000, the Logarithme of 100 is 2, and ſo of the reſt in their order; And this *Charact.* ought to be ſevered by a point from the reſt of the Logarithme, as you may obſerve by the ſame Table.

The Characteriſtique of a Logarithme.

VI. *The Characteriſtiques of the Logarithms aſſigned to the numbers, which are propounded in the Table aforegoing, increaſe by unities.* For example, the *Characteriſt.* of 0.00000 the Logarithme of 1 being 0, the *Charact.* of 1.00000 the Logarithme of 10 (which poſſeſſeth the place of the next *proportionall* in the ranke) is 1, and the *Charact.* of 2.00000 the Logarithme of 100 (the third *proportionall*) is 2, and ſo ſucceſſively of the reſt.

VII. *The Characteriſtique of the Logarithme*

rithme of any number comprehended betwixt any two of the Proportionals in the Table differs not from the Characteriſtique of the Logarithme of the firſt of thoſe two Proportionals: For the better underſtanding of this rule, peruſe the Table following, where in the column C, you may obſerve a rank of numbers *Geometrically* proportionall from 1, and juſt againſt each number his reſpective Logarithme in the column D, calculated according to the *reaſon* and *proportion* of the Logarithmes in the premiſed table A B, ſo that ſuppoſing the Logarithme of 1 to be 0.00000, and the Logarithme of 10 to be 1.00000, the Logarithme of 2 wil be found to be 0.30102, & the Logarithme of 4 to be 0.60205, as ſhall further appear hereafter.

Now then in this Table you may obſerve, that 2, 4, and 8, being numbers comprehended betwixt 1 and 10, the *common Characteriſtique* of their Logarithmes is 0, *viz.* the *Charact.* of

C	D
1	0.00000
2	0.30102
4	0.60205
8	0.90308
16	1.20411
32	1.50514
64	1.80617
128	2.10720
256	2.40823
512	2.70926
1024	3.01029
N. pr	*Their Lo*

0.00000

0.00000 the Logarithme of 1; So likewise 16,32, and 64, being numbers conteined between 10,& 100, the *Charact.* of their logarithmes is 1 *viz.* the *Charact.* of 1.00000, the logarithme of 10: In like manner the *Charact.* of the logarithmes of 128, 256, and 512 (being numbers scituate betwixt 100. and 1000) is 2; And 3 being the *Charact.* of the logarithme of 1000, is also the *Charact.* of 3.01029 the logarithme of 1024, being a number scituate betwixt 1000 and 10000: The same likewise may be understood of the logarithmes of all other numbers whatsoever comprehended betwixt those *proportionall* numbers of the Table, A, B, as aforesaid.

VIII. *The Characteristique of any Logarithme is always an Unit lesse then the Number of Places, of which the number that borrowes it doth consist*: For if a logarithme be propounded which hath for his *Characteristique* 0, the number unto which that logarithme appertaines (by the rule aforegoing) exceeds not 10, and therefore must needs consist of one onely place: So in the table CD 0.90308 whose *Characteristique* is 0, is the logarithme of 8, being a number

that

that consists of one place: in like manner when a logarithme is propounded which hath for his *Characteristique* 1, the number unto which that logarithme belongs, consists of two places: so again in the table C, D, 1.80617, whose *Characteristique* is 1, is the logarithme of 64, which consists of two places: and so consequently of the rest.

IX. *The Logarithmes of this kind ought all to consist of equall places:* For you may propound them to consist either of six places as those in the premised Tables A, B, and C, D, or of *fifteen*, as Mr. *Brigges* hath thought most convenient (principally for large computations) Or of as many places as you please, but when you have once determined of how many places the Logarithmes of your Table shall consist, you must not alter your first resolution, as to make the Logarithme of 2 to be 30102, *viz.* to consist of *five* places, and the Logarithme of 16, *viz.* 1.20411 to have *six*; but rather in this case you are to prefix before 30102 a cypher to make it consist also of *six* places, and then the compleat Logarithme of 2, will be 0.30102, as in the Table C, D, which 0 serves like-

likewiſe for the *Charact.* of that Logarithme, according to the 5 rule of this chapter.

The Arithmeticall complement of a Logarithme

X. *The Arithmeticall complement of a Logarithme is the remainder of the other part thereof (beſides the Characteriſtique) being deducted out of the whole Logarithme of* 10. So the Logarithme of 10 in the Table A, B, being 1.00000, If I ſubſtract 60205 (the reſt of the Logarithme of 4 beſides the *Charact.* in the Table C, D,) the remainder is 39795, which is the *Arithmeticall complement* of 0.60205, the Logarithme of 4: In like manner 79589 is the *Arithmeticall complement* of 1.20411, the Logarithme of 16; And 19383 the *Arithmeticall complement* of 1.80617, the Logarithme of 64.

The nature of Logarithmes.

XI. *Having put the Logarithme of* 1 *to be* 0.00000, *In multiplication the ſumme of the Logarithmes of the multiplicand and of the multiplicator is equall to the Logarithme of the product.* For as much as in every multiplication there are four *proportionall* numbers, that is, as 1 is to the multiplicand, ſo is the multiplicator to the product, according to the 27 rule of the 20 chapter of the 1 book, And the Logarithme of 1 being 0.00000 it is manifeſt by the laſt

1. In Multiplication.

rule

rule of the chapter aforegoing, that the *ſumme* of the Logarithmes of the multiplicand and multiplicator is equall to the *Logarithme* of the product; For *example*, 16 being given to be multiplyed by 4, the product is 64, and here the *proportionall* numbers are 1, 16, 4, and 64, (for as 1 to 16, ſo is 4 to 64) I ſay then that the *ſumme* of the Logarithmes of 16 and 4 (the two *mean* numbers of that proportion) is equall to the *ſumme* of the Logarithmes of 1 and 64, (the two *extreams*) by the rule laſt cited: but the Logarithme of 1 being 0.00000 the *addition* thereof alters not the Logarithme of 64, therefore the *Logarithme* of 64 the product, muſt needs be equall to the *ſum* of the Logarithmes of 16 and 4, the termes propounded to be multiplyed: For better explanation of this *rule* find in the premiſed table C, D, the Logarithme of 16, which is 1.20411, as alſo the Logarithme of 4, being 0.60205, theſe logarithmes if you add together, their *ſumme* is 1.80616, which is the logarithme of 64 (the product) as you may obſerve by the ſame table: for the want of an unit or two in the laſt figure of the logarithme produced cauſeth no errour in the work.

XII. *In*

2. In Diviſion.

XII. *In diviſion the ſumme of the Logarithmes of the Diviſor and of the Quotient is equall to the logarithme of the Dividend:* For (by the 27 *rule* of the 20 chapter of the 1 book before cited) as the diviſor is to 1, ſo is the dividend to the quotient: and therefore (1 being always in *diviſion*, one of the mean numbers of that proportion) I ſay the Logarithme of the dividend, notwithſtanding the *addition* of 0.00000 (the Logarithme of 1) unto it, remaines ſtill the ſame without alteration: for *example*, 64 being given to be divided by 4, the quotient will be 16, and the *ſumme* of the Logarithmes of 4 and 16 is equall to the *Logarithme* of 64, as appears by the *example* of the laſt rule.

3. In proportionall numbers.

XIII. *In any continued rank of numbers Geometrically proportionall from* 1, *the Logarithme of any one of them being divided by the denomination of the power, which it challengeth in the ſame ranke, the quotient will give you the Logarithme of the Root:* In the rank of the *proportionall* numbers of the Table C, D, 2 being the *root* or firſt power, 4 the *ſquare* or ſecond power, 8 the *cube* or third power, 16 the *biquadrate* or fourth power, 32 the fift power, 64

*Vide l.*1.*chap.* 20.*r.*20.

the

the ſixt power, &c. I ſay the Logarithme of 4, 8, 16, 32, 64, or of any of the other ſubſequent *proportionals* in that rank being divided by the *denomination* of the power that the ſame *proportionall* claimeth in the ſame rank, you ſhall finde in the quotient the Logarithme of 2 the *root*; for example, in the ſame Table the Logarithme of 4 (the *ſquare* or ſecond power) *viz.* 0.60205 being given, I demand the Logarithme of 2 the *root*: here the *denomination* of the power, that the *proportionall* 4 challengeth in that rank (being the *ſquare* or ſecond power) is 2, wherefore if 0.60205 the logarithme of 4 be divided by 2, the quotient will be 0.30102. which is the logarithme of 2 the *root*, as you may obſerve by the ſame Table: So likewiſe 0.90308, the logarithme of 8 (the *cube* or third power) being divided by 3, leaves you in the quotient, the ſame 0.30102; And 3.01029 the logarithme of 1024 (the tenth power) being propounded and divided by 10 (the *denomination* of his power) gives you in the quotient 30102, before which if you prefixe 0 for the *Characteriſtique* (according to the ninth rule aforegoing) the totall is 0.30102, *viz.* the loga-

logarithme of 2 the *root*, as before: And ſo conſequently of the reſt. The *truth* of this rule may be evidently demonſtrated by the *definition* of *Logarithmes* being conſidered together with the 12 *rule* of the 20 chapter of the 1 Book.

XIIII. *In any continued rank of numbers geometrically proportionall from* 1, *the Logarithme of the root being multiplied by the denomination of any of the powers, the product is the Logarithme of the ſame power:* This rule is the *inuerſe* of the laſt: *Example,* In the rank produced in the laſt rule, 0.30102 (the logarithme of 2 the *root*) being *doubled*, or multiplied by 2, produceth 0.60204, the logarithme of 4, the *ſquare*, or ſecond power, and the ſame logarithme 0.30102 being *trebled* or multiplyed by 2, produceth 0.90306, the logarithme of 8 the *cubr*, or third power, and ſo of the reſt.

How to find the Logarithmes of mean Numbers.

XV. *In the premiſed Table A, B, the Logarithme of* 1 *being put*, 0.00000, *the Logarithme of* 10, 1.00000, *the Logarithme of* 100, 2.00000, *&c. in the next place it is requiſite to finde the Logarithmes of the mean numbers ſituate amongſt theſe proportionals of the ſame Table: viz.* of 2, 3, 4, &c. which are numbers ſituate betwixt 1, and 10;

of 11, 12, 13, &c. which are *placed* betwixt 10 and 100; and ſo conſequently of the reſt: wherefore how this alſo may be done we intend to explain by the *rules* following.

XVI. *Making choice of one of the proportionall numbers in the Table A, B, by a continued extraction of the ſquare root, create a rank of continuall means betwixt that number and* 1, *in ſuch ſort that the continuall mean which comes neereſt* 1 *may be a mixt number leſſe then* 2, *and ſo neer* 1, *that it may have ſix cyphers before the ſignificant figures of the numerator.*

Example, In the premiſed Table A, B, I take 10, the *ſecond* proportionall of that Table; then annexing unto it (according to the direction given you in the 19 *rule* of the 17 Chapter of the 1 Book) a competent company of cyphers, (*viz.* four &twenty) I extract the *ſquare root* thereof, which I finde to be 3.162277660168; again annexing unto this *root* thus found twelve cyphers, & working by that intire number ſo ordered, as if it were a whole number, I extract the *root* thereof, which I finde to be 1.778279410038: and ſo proceeding ſucceſſively (according to the 23 *rule* of the 20 Chapter of the 1 Book)

by

by a continued extraction I produce four and twenty *continuall meanes* betwixt 10 and 1, and write them down in the first column of the *Table* hereunto annexed, in which you may observe the three last numbers marked by the *letters* g, h, and l, *viz.*

1.000000548979
1.000000274489
1.000000137244

to be each of them *mixt numbers* less then 2, and greater then 1, and likewise to have *six cyphers* placed before the significant figures of their numerators, according to the true meaning and intention of this present *rule*.

	10.000, &c.	1.0000000000000	
a	1.162277660168	0.500000000000	*d*
b	1.778279410038	0.250000000000	
c	1.333521432163	0.125000000000	
	1.154781984689	0.062500000000	
	1.074607828321	0.031250000000	
	1.036632928437	0.015625000000	
	1.018151721718	0.007812500000	
	1.009035044241	0.003906250000	
	1.004507364254	0.001953125000	
	1.002251148292	0.000976562500	
	1.001124941399	0.000488281250	
	1.000562312602	0.000244140625	
	1.000281116787	0.000122070312	
	1.000140548516	0.000061035156	
	1.000070271789	0.000030517578	
	1.000035125277	0.000015258789	
	1.000017567484	0.000007629394	
	1.000008783703	0.000003814697	
	1.000004391842	0.000001907348	
	1.000002195918	0.000000953674	
	1.000001097958	0.000000476837	
g	1.000000548979	0.000000238418	*n*
h	1.000000274489	0.000000119209	*k*
l	1.000000137244	0.000000059604	*m*

But here *obſerve* that although (according to this rule) you are directed to extract ſo many *continuall meanes*, that the laſt ſhould have but *ſix cyphers* before the ſignificant figures of his numerator, yet you are to underſtand, that this is onely neceſſary, when you intend that the Logarithmes of the Table you are to make, ſhould conſiſt of *ſix places*, as thoſe of the premiſed Tables A, B, and C, D: For when you intend the Logarithmes of your Table ſhall conſiſt of *eight*, *ten*, *fifteen* or any other greater number of figures, it will be requiſite to produce ſo many *continuall means*, till the laſt of them may have as many *cyphers* before the ſignificant figures of his numerator, as the Logarithmes of your intended Table ſhall have *places*.

XVII. *Having thus produced a great company of continuall means, annex unto them their proper Logarithmes, by halfing firſt the Logarithme of the number taken, & then ſucceſſively the Logarithmes of the reſt:* For example, 1.000000000000 being put the Logarithme of 10 (the number taken) 0.500000, &c. (marked by the letter *d* in the ſecond Column of the laſt table) which is the halfe of 1.000, &c. is the

the Logarithme of the number *a* (the ſquare root of 10) by the 13 *rule* of this chapter: In like manner 0.25000, &c. being halfe 0.5000, &c. is the Logarithme of the number *b*, and 0.125000, &c. the Logarithme of the number *c*, and ſo of the reſt in their order: So that at laſt as you have in the firſt column of the laſt Table 24 *continuall means* betwixt 10 & 1, as aforeſaid: ſo in the other column you have to each of thoſe *continuall means* his reſpective Logarithme.

XVIII. *When a number which being leſſe then 2 and greater then 1, comes ſo neer to 1, that it hath ſix cyphers placed before the ſignificant figures of the numerator, the firſt ſix ſignificant figures of the numerator of ſuch a number, and the firſt ſix ſignificant figures of the numerator of his ſquare root leſſen themſelves like their Logarithmes, that is to ſay by halfes:* This rule is proved by the laſt Table: for there in the ſecond Column thereof, the number *n* being the Logarithme of the number *g*, I ſay, As the Logarithme *k* is half the Logarithme *n*, ſo 274489, the firſt *ſix ſignificant figures* of the numerator of the number *h*, are half 948979, the firſt ſix *ſignificant figures* of the numerator of the number *g*.

Vide Briggi Arith. l. 2. cap. 6.

XIX. *Therefore any two numbers of this kinde being given, their Logarithmes, and the ſignificant figures of their numerators are proportionall: Example*; The numbers *g* and *h* being given, I ſay, As 548979 the *ſignificant figures* of the numerator of the number *g*, are to 274489 the *ſignificant figures* of the numerator of the number *h*; ſo is 2384185 the Logarithme of the number *g*, to 1192092 the Logarithme of the number *h*; In like manner *g* and *l* being given, as 548979 is to 137244, ſo is 2384185 the Logarithme of the number *g*, to 596046 the Logarithme of the number *l*.

And this *Rule* holds true in any other number of this kinde, though it be not one of the continuall means betwixt 10 and 1; for the ſignificant figures of the numerator of any ſuch number bear the ſame proportion to his proper Logarithme, that the *ſignificant figures* of any of the numbers marked by the letters *g*, *h*, or *l*, bear to his.

XX. *Theſe things being thus cleared, it is manifeſt, that a number of this kinde being given, the Logarithme thereof, may be found by the Rule of Three direct*: for

The proportion used to finde the Logarithmes of Numbers.

As the *significant figures* of the numerator of any one of the numbers (signed in the first column of the last table by the letters *g*, *h*, or *l*) are to his respective *Logarithme*;

So are the *significant figures* of the numerator of the number given, to the *Logarithme* of the same number.

Example, the number 1.000c001021 30 being given, I demand the Logarithme thereof: I say then,

As 48979, the *significant figures* of the numerator of the number *g*, are to 2384185 the *Logarithme* of the same number *g*.

So are 102130 the *significant figures* of the numerator of the number given, to 443545 the *Logarithm required.*

Before which if you prefix *eight cyphers* to the intent it may have as many places as the *Logarithmes* of the last premised Table (*viz.* 14) according to the 9 Rule of this Chapter. The true and entire Logarithme of 1.c0000010213 0, the number given, is 0.c0000c0044 3545, which is also the *Logarithme demanded*, as aforesaid.

XXI. *Wherefore last of all to finde the Logarithme of any number whatsoever, you are*

A generall Rule to find the Logarithme of an Number propounded.

first to search out so many continuall means betwixt the same number and 1, *till the continuall meane that cometh neereſt* 1, *hath ſix cyphers placed before the ſignificant figures of his numerator; Again, this being done, you are in the next place to finde the Logarithme of that continuall mean: And laſtly, by often doubling and redoubling that Logarithme ſo found (according to the number of the continuall means produced) in concluſion you ſhall fall upon the Logarithme of the number given.*

Example, the number 2 being given, I demand the Logarithme thereof: Here firſt in imitation of that which is before taught in the *example* of the 16 Rule of this preſent Chapter, I produce ſo many *continuall means* betwixt 2 and 1, till that which comes neereſt 1 hath ſix cyphers before the *ſignificant figures* of the numerator, which after twenty continued extractions I finde to be 1.000006610 36; this *continuall mean* being thus found by the rule aforegoing I find the Logarithme thereof, which is 0.0000002870842: This Logarithme being *doubled*, will produce (by the 14 Rule of this Chapter) the Logarithm of the *continuall mean* next above 1.000006610 36, and ſo by *doubling* ſucceſſively the Logarithme of each *continuall*

nuall mean one after another according to the number of the extractions (*viz. twenty* times in all) at last I happen upon the Logarithm 0.301029960209 92, which is the Logarithme of 2, the number propounded; the whole *fabrick* of the work is evidently expressed by the Table hereunto annexed.

2.0000, &c.	0.301029960209 92
1.414213562373	0.150514801049 6
1.189207115002	0.075257400524 8
1.090507732665	0.037628700262 4
1.044273782432	0.018814350131 2
1.021897148656	0.009407175065 6
1.010889286052	0.004703587532 8
1.005429901113	0.002351793766 4
1.002711275050	0.001175896883 2
1.001354719892	0.000587948441 6
1.000677130693	0.000293974220 8
1.000338508052	0.000146987110 4
1.000169229705	0.000073493555 2
1.000084616274	0.000036746777 6
1.000042307241	0.000018373388 8
1.000021153396	0.000009186694 4
1.000010576622	0.000004593347 2
1.000005288307	0.000002296673 6
1.000002644150	0.000001148336 8
1.000001322074	0.000000574168 4
1.000000661036	0.000000287084 2

But now (becauſe our intended Logarithmes conſiſt onely of *ſix places*, as may appear by the expoſition of the 16 rule aforegoing) of the Logarithme ſo found, I take onely the firſt *ſix figures*, rejecting the reſt as ſuperfluous, and then at laſt the proper Logarithme of 2, the number given wil be found to be 0.30102, as before in the premiſed Table *C*, *D*: and thus as the Logarithme of 2 is found out, ſo may the Logarithme of any other number whatſoever be known: howbeit the Logarithmes of ſome few of the *Prime* numbers being by this means once diſcovered, the Logarithmes of many other *derivative* numbers may be found out without the trouble of ſuch continued *extraction* of the ſquare root: for *example*, Having found the Logarithme of 2, you may eaſily finde the Logarithme of 5, for dividing 10 by 2, the quotient is 5, but the ſumme of the Logarithmes of the diviſor and quotient is equall to the Logarithme of the dividend, by the 12 Rule of this Chapter. Therefore if I ſubſtract 0.30102, the Logarithme of 2 from 1.00000, the Logarithme of 10, the remainder 0.69898 is the Logarithm of 5.

An eaſier way how to finde the Logarithmes of Derivative Numbers. *Vide Briggii Arith. Log. cap.7.*

Again,

Again, beſides the Logarithme of 5 with like *facility* may you finde the Logarithme of any other number that is made by the multiplication or diviſion of theſe three numbers 5, 2, and 10; *viz.* Of the numbers 4,8,16,32,64, &c. Of the numbers 25,125,625,&c. Of the numbers 20,50,100,200, &c. Obſerving the direction given you in the 11,12,13,& 14 Rules of this preſent Chapter.

After this manner the Table of Logarithmes hereunto annexed is framed, in which you may obſerve the columns (intituled N) to contein all numbers from 1 to 100 as they ſtand one after another in their *naturall* order; and in the other columns (ſigned at the top by *Logarith.*) you have juſt againſt each number his *reſpective* Logarithme: So at the beginning of the ſame Table 0.00000 is the Logarithme of 1, 0.30102 is the Logarithme of 2, 0.47712 the Logarithme of 3, &c.

N	Logarith	N	Logarith	N	Logarith
1	0.00000	34	1.53148	67	1.82607
2	0.30102	35	1.54407	68	1.83251
3	0.47712	36	1.55630	69	1.83885
4	0.60205	37	1.56820	70	1.84510
5	0.69897	38	1.57978	71	1.85126
6	0.77815	39	1.59106	72	1.85733
7	0.84509	40	1.60206	73	1.86332
8	0.90308	41	1.61278	74	1.86923
9	0.95424	42	1.62325	75	1.87506
10	1.00000	43	1.63347	76	1.88081
11	1.04139	44	1.64345	77	1.88649
12	1.07918	45	1.65321	78	1.89209
13	1.11394	46	1.66276	79	1.89763
14	1.14613	47	1.67210	80	1.90309
15	1.17609	48	1.68124	81	1.90848
16	1.20412	49	1.69019	82	1.91381
17	1.23045	50	1.69897	83	1.91908
18	1.25527	51	1.70757	84	1.92428
19	1.27875	52	1.71600	85	1.92942
20	1.30103	53	1.72427	86	1.93449
21	1.32222	54	1.73239	87	1.93952
22	1.34242	55	1.74036	88	1.94448
23	1.36173	56	1.74819	89	1.94939
24	1.38021	57	1.75587	90	1.95424
25	1.39794	58	1.76343	91	1.95904
26	1.41497	59	1.77085	92	1.96379
27	1.43136	60	1.77815	93	1.96848
28	1.44716	61	1.78533	94	1.97313
29	1.46239	62	1.79239	95	1.97772
30	1.47712	63	1.79934	96	1.98227
31	1.49136	64	1.80618	97	1.98677
32	1.50515	65	1.81291	98	1.99123
33	1.51851	66	1.81954	99	1.99563
				100	2.00000

This ſhort Table (which contains onely the logarithmes of all numbers under 100) may be ſufficient to acquaint you with the ordinary way of placing logarithmes in a Table; For, in this manner Mr. *Briggs* his *Chiliads* (augmented by *Ulac*) contein the logarithmes of all numbers under 100000: Howbeit, becauſe the logarithmes ſo expreſt increaſe to ſuch an extraordinary Bulk (*viz.* to a book in *Folio*) that (beſides the importableneſſe thereof) many leaves are turned over, and much time ſpent before the logarithme ſought for can be diſcovered: for this cauſe in the enſuing Chapters is taught the uſe of an Inſtrument, by which (being conteined onely in ten pages of this Volume) the logarithme of any number under 100000 (ſo farre forth as is requiſite for ordinary uſe) may be much more readily diſcovered.

Chap. 3.

The Definition of the line of Proportion.

I. *THus farre the Tabular conſtruction of Logarithmes; their lineall conſtruction en-*

The lineall construction of Logarith.

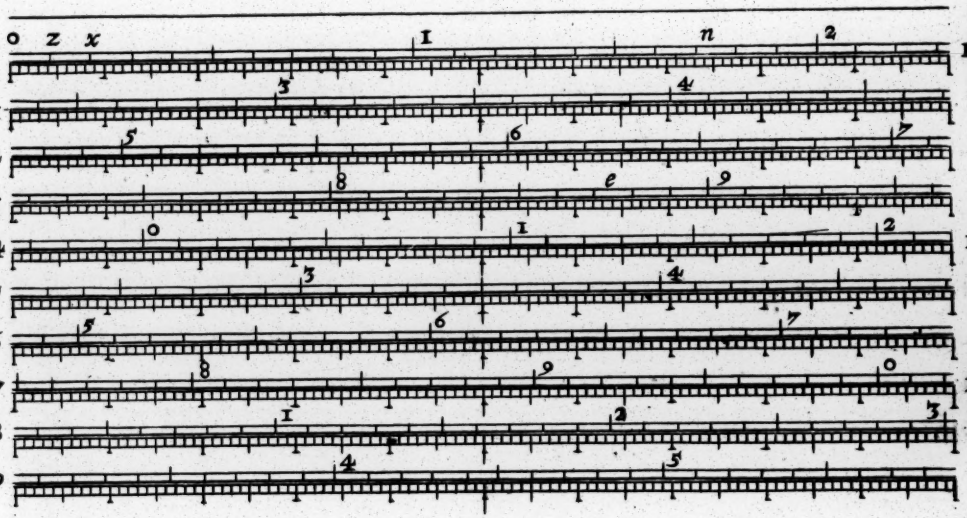
ensues, which consists in framing an Instrument, not unfitly called the line of Proportion. As the French call the Sector the *Compasse of Proportion*, and as Mr. *Gunters* Rule is termed the *Rule of Proportion*, so may this Instrument be fitly called the line of Proportion; because though it seemes to consist of diverse lines, yet is it upon the matter but one line, and besides presents unto you the resolution of all questions Arithmeticall, as well in broken and mixt, as in whole numbers, and that onely by Addition and Substraction, as shall be further declared by that which follows.

The definition of the line of Proportion.

II. *The line of Proportion is a double Scale broken off into Fractions upon which the Logarithmes of Numbers may be found out.* And (indeed) the *line of Proportion* is nothing else but an *Instrumentall* table of Logarithmes: For as in them you have all the figures both of the numbers and Logarithmes set down at large, so here you may gather and collect them upon the severall Scales of this *Instrument*.

A Fraction.

III. *A Fraction of the line of Proportion is an equall part of the same line, consisting of lines and spaces:* So the *line of Pro-*



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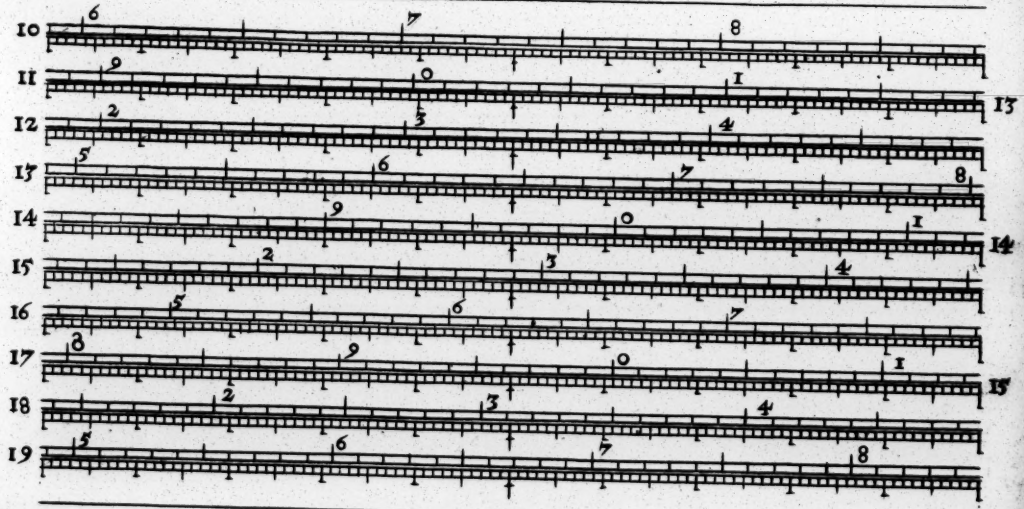
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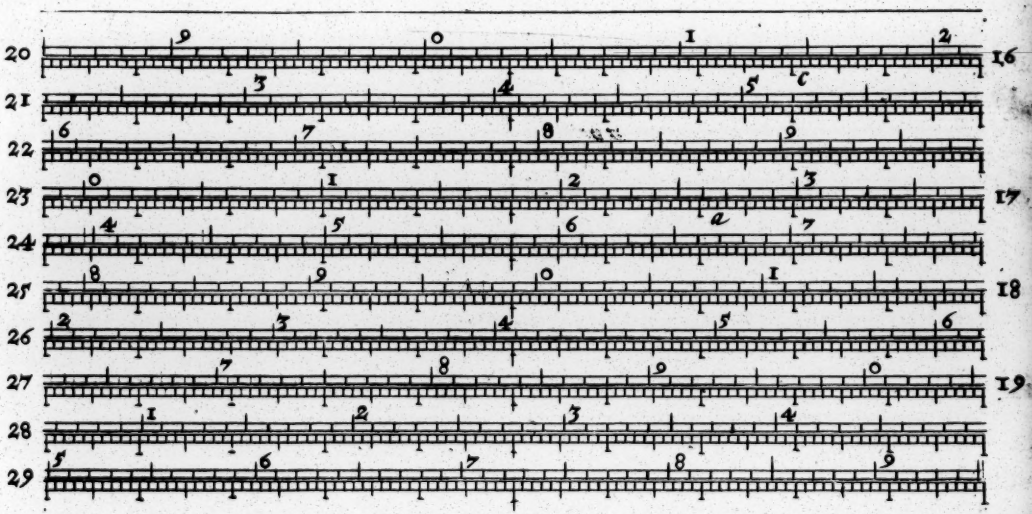
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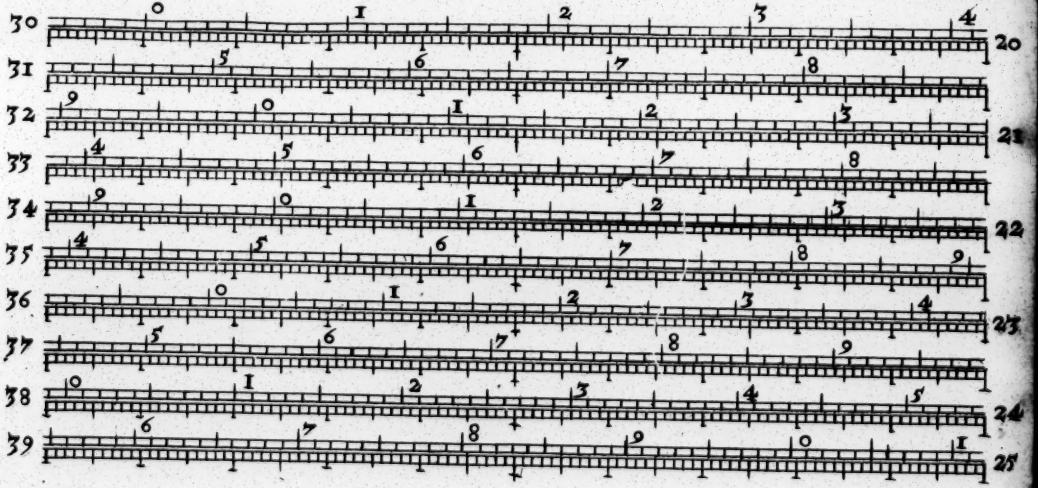
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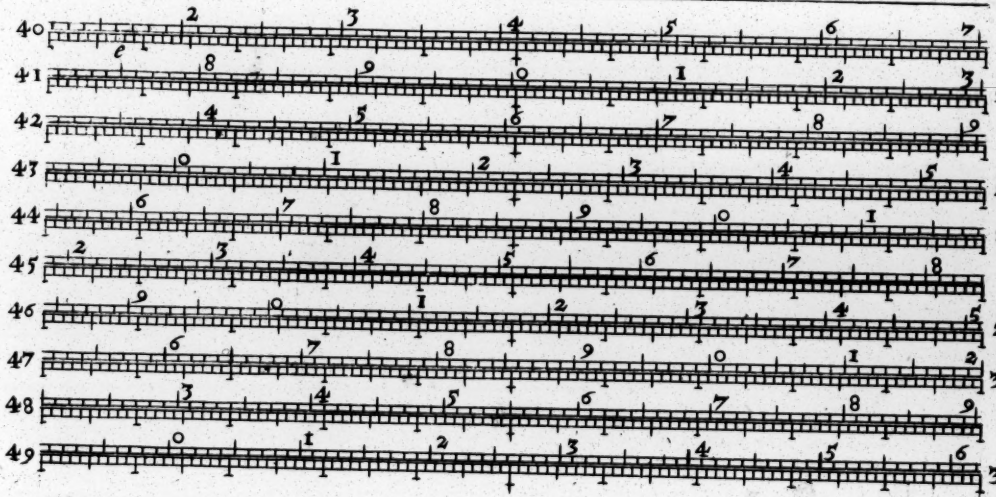
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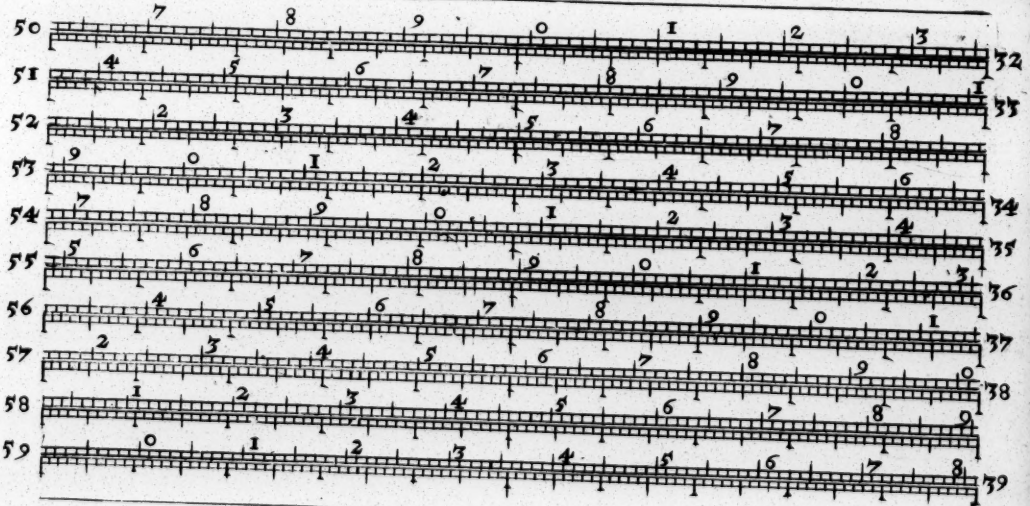
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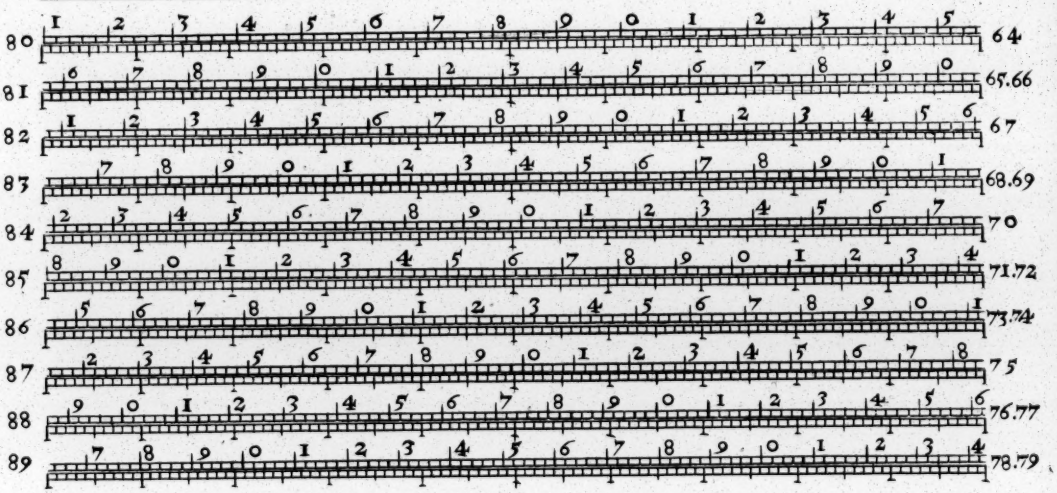
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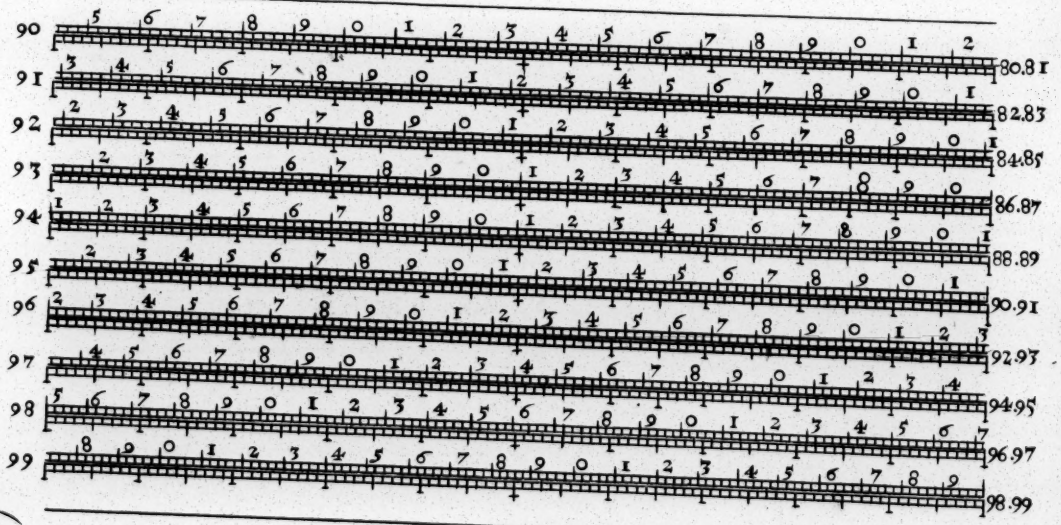

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Proportion hereunto annexed, is broken off or divided into an hundred of thoſe equall parts or fractions, of which the part ſigned by 00 is the firſt, that ſigned by 01, is the ſecond, &c. and each of theſe *fractions* conſiſts of four lines and three ſpaces.

IV. *Theſe fractions together with their lines and ſpaces muſt be underſtood to joyn reſpectively one to another, in ſuch ſort, that the whole line of Proportion may be conceived to be one intire and continued line*: For *example*, the *right* end of the firſt fraction (marked by 10) muſt be conceived to joyn with the *left* end of the ſecond fraction noted by 01; And the *right* end of the ſecond fraction muſt be underſtood to joyn with the *left* end of the third fraction, marked by 02; And ſo conſequently of the reſt in their order. So that the whole *line of Proportion* beginning at the *left* end of the firſt fraction (marked by 00) and ending at the *right* end of the laſt fraction (ſigned by 98 and 99) muſt be conceived to be one entire line, as aforeſaid.

A double Scale.

V. *A double ſcale is, when two ſeverall ſcales meet upon one common line or ſpace.* So here, when you conceive all the fractions

to be linked together as aforesaid, the intire *line of Proportion* is understood by that means to consist of four lines and three spaces, in the uppermost of which spaces you may observe a scale of *proportionall* parts, and in the lower space a scale of *equall* parts; both of them abutting, (*viz.* the one upwards, and the other downwards) upon the middle blank space intercepted betwixt the other two: I say therefore this Instrument (the *line of Proportion*) being thus composed of two severall scales, which meet upon that middle or common blank space, may fitly be called a *double scale*.

Chap. 4.

The description of the Scale of Logarithmes.

I. *The line of Proportion consists of two scales*, viz. *the scale of Logarithmes, and the scale of numbers.*

II. *The scale of Logarithmes is a scale of equall parts, described under the middle space, and abutting upwards upon the same space:* viz. in the lower space of the line of Proportion under the said middle blank space.

III. *The*

III. *The ſcale of Logarithmes is firſt divided by the fractions themſelves into certain equall parts, which are therefore in the uſe of the ſame ſcale called Fraction-parts.* The intire *Line of Proportion* being broken off into 100 Fractions (as you may prove by the expoſition of the ſecond Rule of the Chapter aforegoing) the lower ſpace thereof, which is under the aforeſaid middle ſpace, muſt needs likewiſe be divided into 100 equall parts, which are hereafter termed *Fraction-parts*, ſo the ſpace which you finde placed upon the firſt Fraction under the middle ſpace 00 and 10, is the firſt *Fraction-part*; again, that ſcituate under the middle ſpace upon the ſecond Fraction, is the ſecond *Fraction-part*, and ſo conſequently of the reſt. Fraction-parts.

IV. *The Fraction-parts of the ſcale of Logarithmes are ſigned by figures, which hereafter in the uſe of the ſame ſcale are called Fraction-figures:* So 00 (being placed a little without the left end of the firſt Fraction-part) are the *Fraction-figures* of the ſame part. In like manner 01 are the *Fraction-figures* of the ſecond Fraction-part, 02 the *Fraction-figures* of the third Fraction-part, and ſo of the reſt. Fraction-figures.

V. *Every*

Hundreds. V. *Every Fraction-part is ſubdivided into ten other equall parts called hundreds*, and theſe you ſhall finde diſtinguiſhed from the other diviſions of the *Scale of Logarithmes* by certain *blunt* croſſes, onely each fifth part is marked by a *perfect* croſs, to ſignifie, that it is the middle or fift hundred.

Tenths. VI. *Every hundred is again divided into ten other equall parts called Tenths*, all which are comprehended within the lower ſpace of the *line of Proportion*, except that in the midſt, which appears a little from under the lowermoſt line, to ſhew that it is the middle or fifth tenth.

Units. VII. *Every Tenth is ſuppoſed to be likewiſe divided into ten equall parts called units.* For the diſtance between the tenths being ſo ſmall as you ſee them upon this our preſent *Inſtrument*, they will not admit any reall diviſion of the ſame tenths unto ten equall parts; and therefore you are to ſuppoſe them to be ſo divided, and hereafter when you ſhall have occaſion to uſe thoſe parts you muſt gueſs at them as to direct your eye to the middle of them, when you are to take five of thoſe units, and ſomething beyond the middle, when ſix of them are propounded, &c.

And

And here *obſerve*, if you hereafter happen to miſſe one, two, or three units of the truth what the figure repreſented amongſt theſe parts ought to be, yet that will occaſion no errour in the uſe of this Inſtrument, as will more cleerly appear hereafter.

VIII. *The figures propounded to be found or to be taken off upon the ſcale of Logarithmes ought always to conſiſt of five places, whereof the two firſt you ſhall finde amongſt the Fraction-figures placed at the beginning or left ends of the Fraction parts, and the other three are to be collected out of the diviſions of the Fraction-part, unto which thoſe two firſt figures ſo found do belong*: So 23724 being given to be found upon the *ſcale of Logarithmes*, I demand the point of the common ſpace that repreſents thoſe figures: 23, the two firſt figures thereof direct me to the *Fraction-part*, which (at the left end thereof) hath thoſe figures prefixed before it, then for 7 (the third figure) I count ſeven *hundreds* of that Fraction part, *viz.* to the ſeventh blunt croſs from the ſame figures 23 towards the right hand: again, for 2 I count two *tenths* of the hundred laſt taken, that is, two of the diviſions conteined betwixt

The uſe of the ſcale of Logarithmes

the ſaid ſeventh blunt croſſe, and the next that followes. And for 4 (the laſt figure) I count four *units* of the tenth laſt taken, *viz.* four of the ſuppoſed parts conteined betwixt the ſame tenth and the next that followes. All this performed, I finde the figures given to be repreſented upon the Fraction-part, ſigned (at the left end thereof) by 23 at the point of the common ſpace there which is ſcituate juſt above the letter *a*, ſo 23720 are repreſented, where the ſaid ſecond tenth laſt taken abuts upon the ſaid common ſpace, 23700 at the ſeventh *blunt croſſe* above-mentioned, 23000 at the *beginning* of the ſame Fraction-part, the four cyphers following ſignifying, that no hundreds, tenths or units are to be taken in finding out the point of the commonſpace, which repreſents thoſe figures: In like manner 20807 are found out upon the Fraction-part ſigned by the figures 20, juſt above the Letter *t*, *viz.* ſeven units more forward than the eight blunt croſſe of that Fraction-part, the cypher in the fourth place ſhewing that no tenths are to be taken in the finding out thoſe figures upon the ſcale: So likewiſe 00043 and 00086 are found upon the firſt Fraction-part, juſt under the letters *z* and *x*, &c. IX.

IX. *When a point of the common ſpace is propounded in taking off the figures which the ſame point repreſents upon the ſcale of Logarithmes: firſt, take off the units repreſented by that point, and then the reſt in the ſame order. Example*, the point of the common ſpace ſcituate above *a*, (mentioned before in the firſt example of the laſt Rule) being propounded, I demand the figures which the ſame point repreſents upon the *ſcale of Logarithmes*; Here when I have once fixed mine eye upon the common ſpace at the point *a*, removing my view towards the left hand, I obſerve how many *units* are comprehended betwixt the point given and the next *tenth*, which I gueſſe in this example to be *four*, then reteining *four* in mind, & keeping ſtill ſight of the *tenth*, whether mine eye was laſt directed, I marke how many *tenths* are conteined betwixt that *tenth* and the next blunt croſſe or *hundred* (accounting the ſame *tenth* for one, and ſtill proceeding towards the left hand as before,) now the *tenths* I here finde are *two*. This done, reteining *four* and *two* in mind, and keeping ſtill ſight of the *hundred*, whether mine eye was laſt directed, I obſerve how many blunt croſſes

This Rule is the inverſe of the laſt.

or *hundreds* are conteined betwixt that *hundred* and the beginning of the Fraction-part, within which the point given is ſcituate, which here (adding the ſame *hundred* unto them) I finde to be *ſeven*. Again, (having by this means directed mine eye to the beginning of that Fraction-part, and ſtill keeping in minde *four, two, ſeven*) I obſerve the figures, by which that Fraction-part is ſigned, which are 23; laſt of all therefore carrying in mind *four, two, ſeven, three, two*. I write them down backwards, beginning with the *units* firſt, that is firſt ſetting down 4 in the place of *units*, 2 in the place of *tenths*, 7 in the place of *hundreds*, &c. All this performed, I finde the figures repreſented by the point propounded to be 23724: ſo likewiſe upon the ſame Fraction-part the *tenth*, that is, the next point *a* toward the left hand being given, the figures repreſented by it are 23720, becauſe in this caſe the point propounded yields no *units*: Howbeit nevertheleſſe you are to annex a *cypher* in the place of *units* unto the other four figures ſo found, to make it conſiſt of five places, according to the 8 rule of this preſent Chapter. Again, the point where the ſeventh blunt croſſe

of

of the ſame Fraction-part abuts upon the common ſpace being propounded, the figures which that point repreſents, are 23700, becauſe that point yields you neither *units* nor *tenths*; ſo alſo the figures repreſented at the beginning of that Fraction-part are 23000, and the figures repreſented at the beginning of the Fraction part ſigned by 20 is 20000, &c. In like manner upon the ſame Fraction-part the point *c* being given, the figures repreſented by it are 20807, becauſe that point yields you no *tenths*; and the point *e* upon the Fraction-part ſigned by 40, gives you 40077, for in this caſe you finde no *hundreds*, *&c.*

Chap. 5.

The deſcription and conſtruction of the Scale of Numbers.

I. *THe ſcale of numbers is a ſcale of proportionall parts deſcribed above the common ſpace, and abutting downwards upon the ſame ſpace, viz.* in the uppermoſt ſpace of the *line of Proportion* above the ſaid *common ſpace.*

II. *The numbers to be found or taken off*

upon the ſcale of numbers may conſiſt of any number of places, according to the queſtion propounded; as to have one, two, three, four, ſeven, nine, or more places.

The uſe of the ſcale of numbers.

III. *When a number is propounded to be found upon the ſcale of numbers, finde the firſt two figures thereof at the right end of the Fraction ſigned by the ſame figures: Again, for the third figure thereof, finde alſo upon that ſcale (amongſt the ten proportionall parts belonging to theſe figures, and ſigned by* 0, 1, 2, 3, 4, 5, 6, 7, 8, *and* 9) *the diviſion ſigned by the ſame third figure; and for the reſt of the figures of the number given ſearch them amongſt the other leſſer diviſions belonging to that third figure:* It will not (as I conceive) be needfull to inſiſt long upon this expoſition of this Rule, or any further to direct the Reader how to finde or take off numbers upon this ſcale, there being no difference therein from that of the ſcale of Logarithmes, ſave onely that the firſt two figures are placed at the right end of the Fractions, and the ten diviſions belonging to thoſe two figures do at the beginning of the line extend to more Fractions than one, and by degrees grow leſſe and leſſe, in ſuch ſort, that towards the lower end of the line thoſe two figures

figures are ſet double at the right end of one and the ſame Fraction, and in the two laſt pages of the line, the proportionall parts belonging to thoſe figures are onely divided into five, each part implying the value of two; of all which (I doubt not) the induſtrious Practitioner will eaſily apprehend therefore: Nevertheleſſe, (for perſpicuity ſake) I will here annex ſome few *examples* to make the uſe of this Scale the more evident. When 1, 10, 100, 1000, or any other number conſiſting of an unit with cyphers annexed unto it are propounded, they are all repreſented at the beginning of the ſcale of numbers, ſigned by 0, if 101 (ſingle or with cyphers) be given, they are found upon the firſt Fraction at the point ſigned by 1, if 102, at the point there ſigned by 2, &c. if 1015 be given, it is repreſented alſo upon the firſt fraction at the middle diviſion betwixt 1, and 2, which for that cauſe appears ſomewhat above the uppermoſt line, If 10173 be given, it is there alſo found juſt under the letter *n*: And if 10173589, or any other number (of what extent ſoever) are given (the firſt five figures thereof being the ſame with thoſe of the other number 10173) they

they would be all likewiſe repreſented at the point *x*, ſo if 10103 were propounded, it would be found there at the point juſt under the figure 1. In like manner 106 are repreſented upon the third Fraction at the diviſion of the ſcale of numbers ſigned by 6, alſo 10874 are found upon the fourth Fraction juſt under the letter *e*, 10803, upon the ſame Fraction juſt under the figure 8, 90424 upon the ſixt Fraction of the laſt page juſt under the ſecond figure 4, and 91423 upon the ſeventh fraction of the ſame page under the firſt figure 4, &c. And what is here ſaid of a number beginning with 1, muſt alſo be reſpectively underſtood of numbers beginning with the figures 2,3,4,5, or any other digit, as you ſhall find them ſet down upon this ſcale in their due order and proper places.

IV. *The ſcale of numbers is framed by a Table of Logarithmes*; for, ſuppoſing 1000 to be repreſented at the beginning of the line of Proportion, finde in Mr. *Briggs* his Table of Logarithmes (which he calls *Chiliads*) the Logarithm of 1001 which is 3.00043, then (caſting away 3, the Characteriſtique) finde (by the 8 Rule of the laſt Chapter) upon the ſcale

of

of Logarithmes 00043, which are repreſented upon the firſt *Fraction-part* juſt under the letter *z*; This done, juſt againſt that point upon the ſcale of numbers deſcribe the diviſion under *z*, which being the firſt diviſion upon the ſame ſcale repreſents the number 1001; Again, finding upon the ſcale of Logarithmes the reſt of the Logarithme of 1002 beſides the Characteriſtique, which is 00086, deſcribe upon the ſcale of numbers the diviſion under *x*, which repreſents the number 1002 upon the ſame ſcale. Then taking the Logarithme of 1003, do in like manner, and ſo proceed, till you have deſcribed all the diviſions of the Scale of numbers upon the ſame line.

CHAP.

Chap. 6.

The joynt uſe of the Scale of Numbers, and the Scale of Logarithmes together.

To find the Logarithme, 1. Of a whole Number.

I. *A Whole number being given, the Logarithme thereof is found by the Line of Proportion thus: Firſt, ſearch upon the ſcale of Numbers the point that repreſents the number given; Then obſerve upon the ſcale of Logarithmes the figures repreſented by that point: This done, if you prefixe before thoſe figures the correſpondent Characteriſtique of the number given, the intire number ſo ordered is the Logarithme required. Example,* 17268 being given, I demand his *Logarithme*: by the 3 rule of the laſt chapter, I finde 17268 upon the 24 fraction (ſigned at the right end thereof by 17) at the point *a*, which gives me upon the Scale of Logarithmes (by the 9 rule of the 4 chapter aforegoing) the figures 23724, before which (becauſe the number given conſiſts of five places) I prefix 4 for the *Characteriſtique*, according to the 8 rule of the 2 Chapter of this

this book; So that at last I finde the intire *Logarithme* of 17268, the number propounded, to be 4.237724: In like manner by this rule 3.237706 is the *Logarithm* of 1726: 2.233553: the *Logarithme* of 172: 1.233045 the *Logarithme* of 17: 3.230964 the *Logarithm* of 2040: 3.230276. the *Logarithme* of 2008, &c.

II. *To finde the Logarithme of a single fraction, subtract the Logarithme of the numerator out of the Logarithme of the Denominator: This done, the remainder is the Logarithme of the fraction propounded.* So if the Logarithme of $\frac{3}{4}$ were demanded, it would be found 0.12494; for by the last rule the Logarithme of 4 is 0.60206, out of which if you subtract 0.47712 the Logarithme of 3, the remainder is 0.12494, the *Logarithme* of $\frac{3}{4}$ the number propounded.

But here it is to be observed, that the Logarithme of a broken number, or fraction is always *defective*, that is, the value thereof is lesse then 0, or nothing, for the Logarithme of 1 being put 0.00000, the Logarithme of $\frac{3}{4}$, which is lesse then 1, must needs be lesse then nothing; And by how

3	0.47712
4	0.60206
	0.12494

how much neerer a fraction approaches to 1, by ſo much leſſe is the *quantity* of his Logarithme, *& contra:* becauſe as the Logarithmes of numbers, that are greater then 1, increaſe *à nihilo ad infinitum* above : ſo the Logarithmes of numbers leſſe then 1, increaſe likewiſe *à nihilo ad infinitum* under 1: when therefore you meet with a Logarithme of this kind, to diſtinguiſh it from a *perfect* Logarithme, prefix before it this mark —, as in the *example* before premiſed.

In like manner the Logarithme of .25 is —0.60206, and the Logarithme of .05 is —1.30103, &c.

25	1.39794	05	0.69897
100	2.00000	100	2.00000
	—0.60206		—1.30103

3 Of a Decimall.

III. *When the fraction propounded is a Decimall, you may likewiſe know the Logarithme thereof, thus: Firſt, finde upon the Line of Proportion the Logarithme of the decimall given, as though it were a whole number, then taking the Arithmeticall complement of the Logarithme ſo found, if you place before that complement his proper Characteriſtique, (which ought to conſiſt of ſo many*

many unites as the Decimall given hath cyphers prefixt before it) that complement ſo ordered is the Logarithme demanded: For *example*, .25 being given, I demand the Logarithme thereof. The Logarithme of 25 (by the 1 Rule of this Chapter) is 1.39794, whoſe *Arithmeticall Complement* (by the 10 Rule of the 2 Chapter of this book) is 60206, before which if I place the *Characteriſtique* 0 (becauſe the decimall given hath no cyphers prefixt before it) the intire Logarithme of .25 will be found --0.60206, as before in the ſecond example of the laſt rule. In like manner the Logarithme of .05 is 1.30103, for the Logarithme of 5 is 0.69897, whoſe *Arithmeticall Complement* is 30103, before which if I prefix the *Characteriſtique* 1 (becauſe the Decimall given hath one cypher placed before it) I finde the Logarithme of .05 the decimall propounded, to be --1.30103, as before in the laſt *example* of the laſt rule.

A direction how to find the Arithmeticall Complement of a Logarithme by the line of Proportion.

But here obſerve, that the *Arithmeticall Complement* of the Logarithme of any number may be more readily found out by the Line of Proportion, then by the 10 rule of the 2 chap. of this book before cited, *viz.* thus: Having found the number given

given upon the ſcale of Numbers, and by that means directed your eye to a certain point of the common ſpace, obſerve upon the ſcale of Logarithmes how many *Units*, *Tenths*, and *Hundreds* are conteined betwixt that point, and the right end of the fraction-part, within which the ſame point of the common ſpace happens to fall: Then keeping in minde the *Units*, *Tenths* and *Hundreds* ſo taken, mark the *fraction-figures* placed at the beginning of the ſame fraction-part: This done, if inſtead of thoſe figures you take their *Complements* to 9, and laſtly, keeping all thoſe figures in minde ſet them down *backwards*, that number ſo ordered is the *Arithmeticall Complement* of the Logarithme of the number propounded. Example; 17268 being given, I demand the *Arithmeticall Complement* of the Logarithme of the ſame number: This number is repreſented upon the ſcale of Numbers at the point *a* by the 3 rule of the laſt chapter, wherefore removing my view from thence towards the right hand, I obſerve upon the ſcale of Logarithmes how many *units* are comprehended betwixt the ſame point and the next Tenth towards the ſame hand, which I

gueſſe

gueſſe in this example to be *ſix*: Then reteining *ſix* in mind, and keeping ſtill ſight of the Tenth, whether mine eye was laſt directed, I mark how many *Tenths* are conteined betwixt that Tenth and the next blunt croſſe or Hundred (accompting alſo the ſame tenth for one, and ſtill proceeding towards the right hand as before) now the tenths I here finde are *ſeven*: This done, reteining *ſix* and *ſeven* in minde, and ſtill keeping ſight of the blunt croſſe or hundred, whether mine eye was laſt directed, I obſerve how many of thoſe *blunt croſſes* or *Hundreds* are conteined betwixt the ſame blunt croſſe and the end of the Thouſand within which the point given is ſcituate, which here (adding the ſaid blunt croſſe or Hundred unto them) I finde to be *two*, wherefore keeping in mind *ſix*, *ſeven*, *two*, and obſerving the figures placed at the beginning of the ſame fraction-part to be 23, inſtead of them I take *ſix* & *ſeven*, *viz.* their complements to 9, (for 6 is the complement of 3 to 9, and 7 is the complement of 2 to 9) all this performed, if I ſet down *ſix*, *ſeven*, *two*, *ſix*, *ſeven* backwards (as before in the 9 rule of the fourth Chapter) the number I look for is found

to

to be 76276, which is the *Arithmeticall Complement* of the Logarithme of 17268 the number propounded. Upon this, I conclude, If the Logarithme of the Decimall 17268 were demanded (this last direction being obſerved together with the premiſed Rule) it would be found --0.76276, likewiſe the Logarithme of .017268 to be --1.76276, and the Logarithme of .0017268 to be--2.76276 &c. Again, the Logarithme of .25 would be found to be --0.60206, and the Logarithme of .05 to be --1.30103 as before, &c.

4 Of a compound fraction.

IV. *When the Fraction given is compound, Firſt, reduce it to a ſingle Fraction, and then finde the Logarithme thereof as before:* So the Logarithme of 13 s. 5 d. 3f. is --0.17136; for that compound fraction being reduced to a ſingle fraction (by the 15 rule of the 7 chapter of the 1 book) is $\frac{647}{960}$ whoſe Logarithme is --0.17137, by the ſecond Rule of this preſent chapter.

674 2.81093
960 2.98229
--0.17136

V. *Or thus, Convert it to a Decimall, and*

and then finde his Logarithme, as before: And so likewise the Logarithme of 13, s. 5, d. 3, f. will be found to be —— 0.17136: for that number being reduced to a Decimall (by the 4 Rule of the 12 Chapter of the 1 Booke) is .67395, whose Logarithme (by the 3 Rule of this Cha.) is --0.17136, as aforesaid.

VI. *When a mixt number is propounded, to finde his Logarithme, first reduce the number given into an Improper Fraction, then deducting the Logarithme of the denominator out of the Logarithme of the numerator, the remainded is the Logarithme required, Example,* $4\frac{6}{12}$ being given, I demand his Logarithme: that number being reduced to an *Improper* Fraction (by the 9 rule of the 7 Chapter of the 1 booke) is $\frac{54}{12}$: now the Logarithme of 54 (by the 1 Rule of this Chapter) is 1.73240, out of which if you subtract 1.07918, the Logarithme of 12, the remainder is 0.65322, *viz.* the Logarithme of $4\frac{6}{12}$ the number given: In like manner the Logarithme of 172.68 is 2.23724, and the Logarithme of 24, l. 13, s. 5, d. 3, f. is 1.39222, &c.

5 Of a Mixt number. 1 When the Fraction annexed is on Decimal.

54	1.73240
12	1.07918
$4\frac{6}{15}$	0.65322
17268	4.23724
100	2.00000
172.68	2.23724
23687	4.37451
960	2.98229
24,l. 13,s. 5,d. 3,f.	1.39222

2 When the Fraction annexed is a Decimall.

VII. *When the Fraction annexed is a Decimall, you may likewise finde the Logarithme, thus: Conceiving the number given to be a whole number, finde upon the Scale of numbers the point that represents the same number, then observe upon the Scale of Logarithmes the number represented by that point: This done, if you place before that number so found his proper Characteristique, (that is a Figure consisting of so many unites, wanting one, as the whole part of the number given consists of places) that intire number so ordered is the Logarithme required.*

Example, 172.68 being given, I demand

mand his Logarithme: that number, being conceived to be a whole number, is found (by the 3 Rule of the laſt Chapter) to be repreſented in the *Scale of numbers* upon the 24 Fraction at the point *a*, which yeelds me upon the *Scale of Logarithmes* (by the 9 Rule of the 4 Chapter aforegoing) the number 23724: and now becauſe 172 (being the whole part of the number given) conſiſts of three places, I prefix before 23724 the *Characteriſtique* 2, according to the 8 Rule of the 2 Chapter of this booke; which done, the Intire Logarithme of 172.68 the number propounded will be found 2.23724: So the Logarithme of 17.26 is 1.23706, and the Logarithme of 1.726 is 0.23706, &c.

VIII. *When therefore the Fraction annexed is compound, firſt reduce it to a Decimall, and then finde the Logarithme of that number ſo reduced by the Rule aforegoing:* So the Logarithme of 24, l. 13, s. 5, d. 3, f. is found 1.39222, as before; for the broken part of that number being reduced to a *Decimall* (by the 4 Rule of the 12 Chap. of the 1 book) that intire number will be 24.67395, whoſe Logarithme (by the Rule aforegoing) is 1.39222, &c.

How to finde the correspondent number of a perfect Logarithme.

IX. *When a perfect Logarith. is propounded* (viz. *the Logarithme of a number not lesse then* 1) *to finde the correspondent number of that Logarithme, do thus: neglecting the Characteristique of the Logarithme given, finde the point where the other figures thereof are represented upon the scale of Logarithmes: then take off upon the scale of numbers the number represented by that point: this done, observing of how many units the Characteristique of the Logarithme given consists, take one more of the first figures, which the number (so taken off upon the scale of Numbers) hath towards the left hand; as if the Characteristique be* 0. *take one of those figures, if it be* 1. *take two, if* 2. *take three. &c, Which figures so taken will be the whole part of the number required: and if besides there remain any figures towards the right hand, they are a Decimal fraction annexed unto the number demanded:*

Example, The Logarithme 4.23724 being propounded, I demand the number unto which it appertaines, 23724, the other figures, besides the *Characteristique*, I finde (by the 9 Rule of the 4 Chapter of this book) to be represented in the *scale of Logarithmes* upon the 24 fraction-part at the point *a*, at which point upon the *scale* of

of Numbers I find the number 17268 to be represented, by the 3 Rule of the last chapter; And now because the *Characteristique* of the Logarithme given is 4, the intire number 17268 is the number unto which the same Logarithme appertaines; but if the Logarithme propounded were 2.23724. his correspondent number would be 172.68, because in this case the *Characteristique* 2 intimateth that 172, the three first figures of the number found, ought to be taken for the *whole part*, and 68 for the *Fraction* of the number unto which that Logarithme belongs, according to the 8 Rule of the 2 Chapter of this present Book.

X. *Here when the number taken off upon the Scale of Numbers, consists not of so many places, as the Characteristique of the Logarithme propounded doth require, supply that defect by annexing cyphers unto that number so taken.*

Example, The Logarithme 5.23553 being given, I demand his correspondent Number: here 23553, the other figures besides the *Characteristique*, being sought out upon the Scale of Logarithmes, leade me to a point of the Common space, which upon the

the Scale of numbers, gives me the number 172, unto which (becauſe the *Characteriſtique* of the Logarithme propounded is 5) I annex three cyphers, to the end it may conſiſt of ſix places (according to the 8 Rule of the 2 Chapter of this book before cited) and then the intire number unto which the Logarithm given doth appertaine, is 172000: In like manner, 2040000 is the *correſpondent* number of the Logarithme 6.30964, and 20080 of 4.30376, &c.

Of a Defective Logarithme.

XI. *When the Logarithme offered is a defective* (viz *the Logar. of a number leſſe then* 1) *taking the Arithmetical complement thereof, find the point, where that Complement is repreſented upon the Scale of Logarithmes: This done, take off upon the Scale of Numbers the number preſented by the ſame point; then placing before that number for every unit of the Characteriſt. a cypher, and laſtly, prefixing a point before all, to ſhew it to be a Decimall, that number ſo ordered is the correſpondent number of the Logarithme propounded.*

Example, —0.60206 being propounded, I demand the number, unto which it appertaines: The *Arithmeticall Complement* of this Logar. is 39794, which gives me upon the Scale of Logarithmes a

point,

point, that repreſents 25 upon the Scale of Numbers: and now becauſe the *Characteriſtique* of the Logarithme given is 0, I prefix no cyphers before 25, but onely a point to ſigne it for a *Decimall*, according to the 25 Rule of the 1 chapter of the 1 book: All this performed, at laſt, I finde the number (unto which the Logarithme propounded doth appertain) to be .25: but if the logarithme given were —1.30103: his *correſpondent* number would be .05: for the point upon the Scale of Logarithmes where 69897 (the *Complement* of 30103) is repreſented, yeelds you upon the Scale of Numbers the number 5, before which (becauſe the *Characteriſtique* of the Logarithme given conſiſts of one *unit*) if you prefix a cypher and then a point, that number ſo ordered is .05, which is the *reſpective* number of the Logarithme propounded.

And here obſerve that in this caſe the *Arithmetical Complement* of any Logarith. propounded may be readily diſcovered, if neglecting the *Characteriſtique* you ſubſcribe under each of the other figures his reſpective *Complement* to 9, ſave under the laſt towards the right hand, under which you are to write his *Comple-*

A ready way to find the Arithmetic all Complement of a Logarithm

ment to 10; for this performed, you have the *Arithmeticall Complement* of the Logarithme propounded. *Example*, —0.60206 being propounded I demand his *Arithmeticall Complement*: the *Complement* of 6 to 9 is 3, and the *Complement* of 0 to 9, is 9, likewiſe the *Complement* of 2 to 9 is 7, and again, the *Complement* of 0 to 9 is 9; laſtly, the *Complement* of 6 to 10 is 4: now all theſe figures *viz.* 39794 I ſubſcribe under 60206, and then conclude, that the *Arithmetical Complement* of —0.60206, the Logarithme propounded is 39794, as before: ſo likewiſe is 69897 the *Arithmetical Complement* of —1.30103

.25	—0.60206
	39794
.05	—1.30103
	69897

By this time I hope the *Ingenious Reader* doth at leaſt begin to underſtand, why we have taken ſo much paines (in the 12 chapter of the former book) to reduce *Compound Fractions* to *Decimals*: For by that means their *Logarithmes* may be the more eaſily found out upon the *Line of Proportion*: as is apparent by divers *Rules* of this preſent Chapter.

Now howſoever alſo the Fractions of foot meaſure, inch meaſure, and the like

may

may be conveniently reduced to *Decimals* by the ſecond, eight, or ninth *Tablet* of the Table of *Reduction*, produced in the ſaid 12 Chapter: yet the readieſt way to effect that, will be to divide your *Feet*, *Inches*, *&c.* into 10 or 100 parts; for then in meaſuring any length by them, their parts or *Fractions* are reduced to decimals *Ipſo facto*: Likewiſe if in meaſuring by the *Pearch*, you take a *Chain* which (being four *Pearches* in length) is divided into 100 *Links*, you ſhall find it the apteſt for meaſuring of land, the parts thereof reducing themſelves readily into *Decimals*. Again, If you pleaſe, you may divide your Yard and Ell into ſuch like parts for the ſame purpoſe. And indeed if all ſorts of *Money*, *Weight*, *Meaſure*, *Time*, *&c.* were ſo divided by *Decimals* (for example, a Pound *ſterling* into *ten* ſhillings, each ſhil. into *ten* p. each peny into *ten* f. and ſo likewiſe the reſt) their *Calculations* would be much eaſier then they now are, but becauſe it is not in our power to alter or change them from what they are already, we have taught you by the directions premiſed to reduce their fractions to Decimals and have cauſed the ſaid Tablets to be re-inſerted, to the end they may here alſo be ready at hand, without looking back into the other book for them.

The

The TABLE of REDUCTION.

Engliſh Coin.	
Sh. 19	95
18	9
17	85
16	8
15	75
14	7
13	65
12	6
11	55
10	5
9	45
8	4
7	35
6	3
5	25
4	2
3	15
2	1
1	05

D. 11	04583333
10	04166667
9	0375
8	03333333
7	02916667
6	025
5	02083333
4	01666667
3	0125
2	00833333
1	00416667
F. 3	003125
2	00208333
1	00104167

Troy Wai ght.

O. 11	91666667
10	83333333
9	75

	8	66666667
	7	58333333
	6	5
	5	41666667
	4	33333333
	3	25
	2	16666667
	1	08333333
P.	19	07916667
	18	075
	17	07083333
	16	06666667
	15	0625
	14	05833333
	13	05416667
	12	05
	11	04583333
	10	04166667
	9	0375
	8	03333333
	7	02916667
	6	025
	5	02083333
	4	01666667
	3	0125
	2	00833333
	1	00416667

Gr.	23	00399305
	22	00381944
	21	00364583
	20	00347222
	19	00329861
	18	003125
	17	00295139
	16	00277778
	15	00260417
	14	00243056
	13	00225694
	12	00208333
	11	00190972
	10	00173611
	9	00156250
	8	00138889
	7	00121528
	6	00104166
	5	00086805
	4	00069444
	3	00052083
	2	00034722
	1	00017361

Averdupois great waight.

3 qu.	75
2 qu.	5
1 qu.	25
lib. 27	24107142
26	23214285
25	22321428
24	21428571
23	20535714
22	19642857
21	1875
20	17857143
19	16964286
18	16071428
17	15178571
16	14285714
15	13392857
14	125
13	11607143
12	10714286
11	09821428
10	08928571
9	08035714
8	07142857
7	0625
6	05357143
5	04464286
4	03571428
3	02678571
2	01785714
1	00892857
Ou. 15	00837053
14	0078125
13	00725446
12	00669643
11	00613839
10	00558035
9	00502232
8	00446429
7	00390625
6	00334821
5	00279018
4	00223214
3	00167411
2	00111607
1	00055804
3 qu.	00041853
halfe	00027902
1 qu.	00013951

Aver-

Averdupois little waight.

On.	15	9375
	14	875
	13	8125
	12	75
	11	6875
	10	625
	9	5625
	8	5
	7	4375
	6	375
	5	3125
	4	25
	3	1875
	2	125
	1	0625
Dr.	15	05859375
	14	0546875
	13	05078115
	12	046875
	11	04296875
	10	0390625
	9	03515625
	8	03125
	7	02734375
	6	0234375
	5	01953125
	4	015625
	3	01171875
	2	00781 25
	1	00390625
2. qu.		00292969
halfe		00195312
1. qu.		00097656

Liquid Measures.

P.	7	875
	6	75
	5	625
	4	5
	3	375
	2	25
	1	125
	¾	09375
	½	0625
	¼	03125

Drie

Drie Measures.	
Bu. 7	875
6	75
5	625
4	5
3	375
2	25
1	125
Pec. 3	09375
2	0625
1	03125
¾	0234375
½	015625
¼	0078125
Pi. 3	0058594
2	0039063
1	0019531

Long Measures, the Integers being yards & els.	
qu. 3	75
2	5
1	25
nail. 3	1875
2	125
1	0625
3 qu.	046875
halfe	03125
1 qu.	015625

Time.	
mo. 11	916667
10	833333
9	75
8	666667
7	583333
6	5
5	416667
4	333333
3	25
2	166667
1	083333
da. 30	082193
29	079454
28	076714
27	073973
26	071233
25	068495

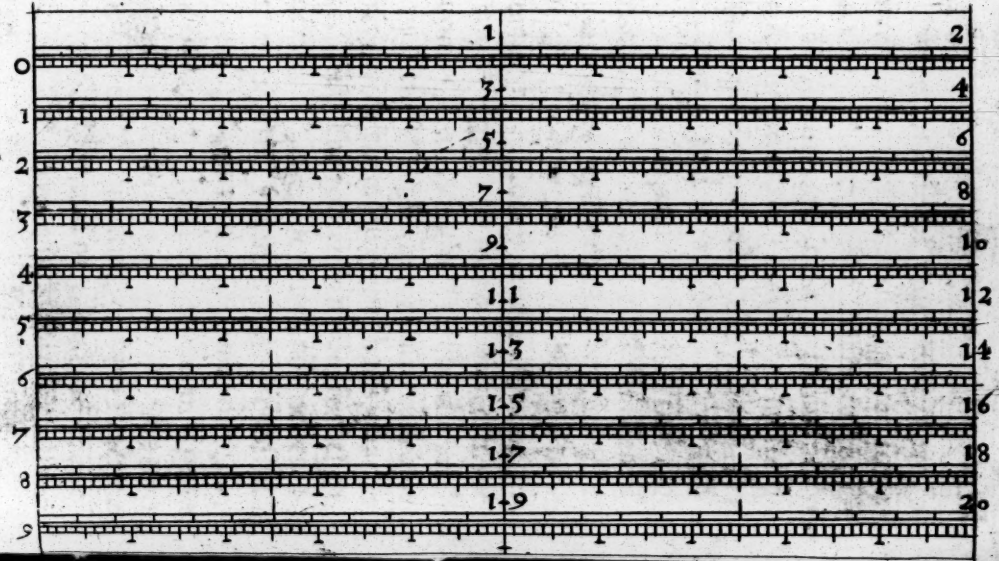
24	065755
23	063016
22	060274
21	057536
20	054795
19	052055
18	049316
17	046577
16	043837
15	041097
14	038357
13	035617
12	032877
11	030137
10	027397
9	024657
8	021918
7	019178
6	016438
5	013698
4	010959
3	0082192
2	0054795
1	0027397

Dozens.

De.	11	9166667
	10	8333333
	9	75
	8	6666667
	7	5833333
	6	5
	5	4166667
	4	3333333
	3	25
	2	1666667
	1	0833333
Pa.	11	076388
	10	0694444
	9	0625
	8	0555555
	7	0486111
	6	0416667
	5	0347222
	4	0277778
	3	0208333
	2	0138889
	1	0069444

Never-

Nevertheleſſe (if you pleaſe) here followeth a more ready way yet for reduction of compound Factions to Decimals (upon view only without addition) by helpe of the Tabular Scales following, upon each of which you ſhall finde the compound Fractions deſcribed in the uper Scales, and their reſpective Decimals in the nether: The firſt of theſe Tabular Scales reduceth Money, and Troy weight, the integres therof being a pound ſterling, for Money, and an Ounce, for Troy Weight: The ſecond reduceth Averdupois Great Weight, The third Averdupois Little Weight, and al other meaſures that divide themſelves into halfs, quarters, &c. And the fourth is made for the reduction of Time, Dozens, and Inches: So, upon the firſt Tabular ſcale (conſiſting of ten Fractions) the Decimal of 8, *ſ.* 3, *d.* 3, *f.* is .4156. and the Decimal of 9 penny weight and 7 grains is .4646: Alſo upon the ſecond (conſiſting of two Fractions onely) the Decimal of 3, *qu.* 8, *lb.* 7, *oun.* is .825: The like reduction may alſo be made upon the other two Tabular Scales according to their ſeverall and reſpective Diviſions, which I leave to the farther ſcrutinie of the Practitioner.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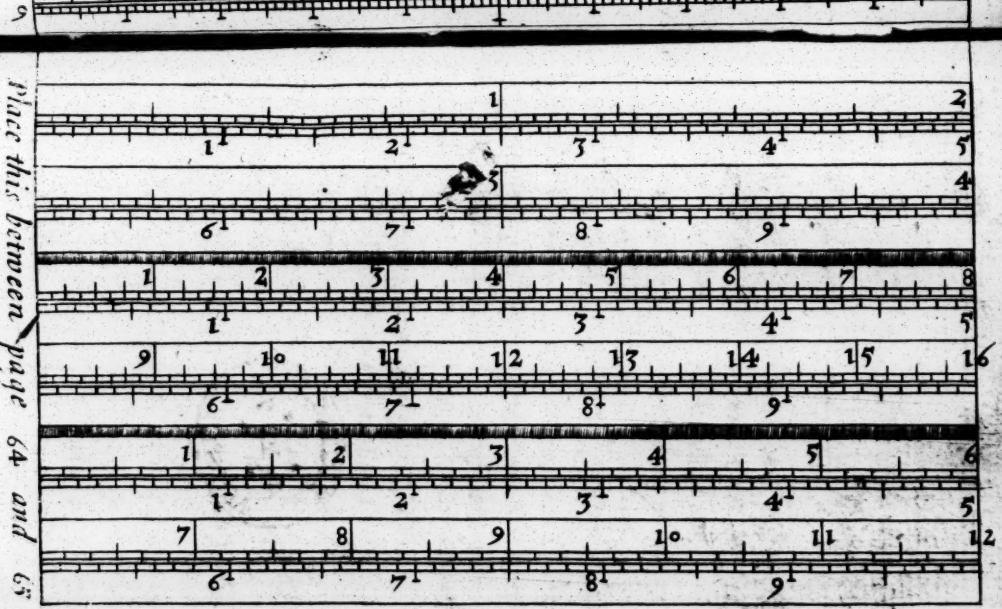
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Chap. 7.

Multiplication by the Logarithmes.

I. *We have done with the Construction of the Logarithmes; in the next place comes their vse to be handled, which consists in the easie resolution of the operations of Naturall Arithmetique.* The use of Logarithmes in Multiplication.

II. *The operations of Naturall Arithmetique, that require an easier way of resolution, are either those of single and comparative Arithmetique, or those other of the rule of False.*

III. *The operations of single Arithmetique here produced to be performed by the helpe of the Logarithmes, are Multiplication and Division, or the Extraction of Roots:* For an easier way to work *Addition* and *Subtraction* need not, nay, cannot be prescribed, then that which is already taught in *Naturall Arithmetique*, which indeed is so prompt and ready, that those operations are onely hereafter used for the easie resolution of all the other operations of *Naturall Arithmetique*, except it be for the Extraction of roots, where *bipartition* and *tripartition* are necessary, as shal more plain appear hereafter.

See the 11 rule of the 2 chapter of this Book.

IV. *To multiply by the Logarithmes, when the Logarithmes of the numbers given are of one & the same kind (that is, all perfect, or all defective Logarith.) add those Logarithmes together; this done, their sum is the Logarithme of the product required, which Logarithme so found is in this case of the same kinde with the Logarithmes of the numbers given.*

Examples 1 Of two whole numbers.

1 *Example*, 144 being given to be multiplied by 12, I demand the *product*. The Logarithme of 144, by the 1 rule of the last chapter, is 2.15836, and the Logarith. of 12, by the same rule, is 1.07919; The *sum* of these Logar. is 3.23755, which by the 9 rule of the last chapter is found to be the Logarith. of 1728. I conclude therefore that 1728 is the *product* of 144, & 12, the numbers propounded to be multiplied.

Multiplicand	144	2.15836
Multiplicator	12	1.07919
Product	1728	3.23755

2 Of two mixt numbers.

2 *Example*, 17.268 being propounded to be multiplied by $4\frac{6}{13}$ what is the *product*? The Logarithme of 17.268 by the 7 rule of the last chap. is 1.23724, and the Logarithme of $4\frac{6}{13}$ by the 6 rule of the same chapter, is 0.65322: The sum of these Logarithmes is 1.89046, which by the 9 rule

rule of the last chapter, is the Logarithme of 77.7, the *product* demanded.

Multiplicand	17.268	1.23724
Multiplicator	$4\frac{6}{12}$	0.65322
Product	77.7	1.89046

3 *Example*, 172.68 being given to be multiplied by 12, I demand the *product*: The Logarithme of 172.68 by the 7 rule of the last chapter is 2.23724, and the Logarithme of 12 is 1.07919: The sum of these Logarithmes is 3.31643, which by the 9 rule of the last chapter is the Logarithme of 2072.2, the number *produced*. 3 Of a mixt and a whole number.

Multiplicand	172.68	2.23724
Multiplicator	12.	1.07919
Product	2072.2	3.31643

4 *Example*, .25 being given to be multiplyed by $\frac{3}{4}$, I demand the *product*: The Logarithme of .25 by the 3 rule of the last chapter is — 0.60206, and the Logarithme of $\frac{3}{4}$ by the second rule of the same chapter is — 0.12494: The sum of these Logarithmes is — 1.72700, which by the last rule of the last chapter is the Logarithme of .1875, the number *produced*. 4 Of two Fractions.

Multiplicand	.25	—0.60206
Multiplicator	¾	—0.12494
Product	.1875	—0.72700
Complement		27300

5 *Example*, The *product* of ¾ multiplyed by .05 is .0375

Multiplicand	¾	—0.12494
Multiplicator	.05	—1.30103
Product	.0375	—1.42597
Complement		57403

See the 14 rule of the 4 chapter of the 1 book. 5 Of three whole numbers.

6 *Example*, 4, 18, and 22 being given, to be multiplyed *continually*, their last *product* will be found 1584.

The numbers given	4.	0.60206
	18.	1.25526
	22.	1.34243
Their product	1584	3.19975

Of one whole, and two mixt numbers.

7 *Example*, 4, 1.8, and 2.2 being given to be multiplyed *continually*, their *product* is 15.84.

The numbers given	4.	0.60206
	1.8	0.25526
	2.2	0.34243
Their product	15.84	1.19975

8 *Example*, .4, .18, and .22 being propounded to be multiplyed together, their last *product* is .01584. 7 Of three Fractions.

The numbers given	.4	−0.39794
	.18	−0.74474
	.22	−0.65757
Their product	.01584	−1.80025
The Complement		19975

V. *When the Logarithmes of the numbers given are of divers kinds, ſubtract the leſſer out of the greater: This done, the remainder is the Logarithme of the product required, which Logarithme is in this caſe alwayes of the ſame kinde with the greater Logarithme of the numbers given.*

1 *Example*, 144 being given to be multiplied by $\frac{3}{4}$, the *product* is 108. Examples. 1 Of a whole number, and a fraction.

Multiplicand	144.	2.15836
Multiplicator	$\frac{3}{4}$	−0.12494
Product	108.	2.03342

2 *Example*, 4 multiplyed by .05, the *product* is .2

Multiplicand	4.	0.60206
Multiplicator	.05	−1.30103
Product	,2	−0.69897
		30103

2 Of a mixt number and a Fraction.

3 *Example*, 172.68 multiplied by $\frac{3}{4}$ *produceth* 129.51.

Multiplicand	172.68	2.23724
Multiplicator	$\frac{3}{4}$	−0.12494
Product	129.51	2.11230

3 Of a mixt number and two Fractions

4 *Example*, 172.68, $\frac{3}{4}$, and .05 being propounded to be multiplied *continually*, their last *product* is 6.475.

The numbers given	172.68	2.23724
	$\frac{3}{4}$	−0.12494
		2.11230
	.05	−1.30103
Their product	6.475	0.81127

VI. *For proof of Multiplication by the Logarithmes repeat the operation backwards, & then if you find no error, you may conclude, that you have rightly performed the Quare.*

Example, In the last premised example the

the numbers propounded were 172.68 $\frac{3}{4}$, and .05, unto which I find as Logarithmes theſe numbers following, *viz.* 2.23724, −0.12494, and −1.30103; wherefore now for *trial* of the work, ſuppoſing thoſe Logarithmes to be propounded, I make ſearch for their *correſpondent* numbers, and ſo I find the number, unto which 2.23724 belongs, to be 172.68: likewiſe that, unto which −0.12494 appertains to be $\frac{3}{4}$, (becauſe if I add the Logarithme of 3 the *Numerator*, *viz.* 0.47712 unto 0.12494, their ſum makes 0.60206 the Logarithme of 4 the *Denominator*: and laſtly, the number, unto which −1.30103 belongs to be .05, whereupon I aver, that in finding the *Correſpondent* Logarithmes of the numbers propounded I have proceeded right. Againe, 0.81127 being the Logarithme of the *product* or number required, to know whether I have rightly taken 6.475, that *product*, I ſeach the Logarithme thereof, which finding to be 0.81127, I conclude likewiſe, that I have not erred in diſcovering the ſame *product*. The reſt of the worke being performed by *Addition* and *Subtraction*, for proofe thereof I referre you to the laſt rule of the 3 chapter of the 1 Book.

And

And by this meanes all the ſubſequent *operations* wrought by the Logarithmes may be likewiſe examined: So that it will not be neceſſary to produce any other *rules* hereafter for their proofes, the intent and meaning of this preſent *rule* being duely obſerved.

VII. *When the value of any certain quantitie is demanded according to the rate of the Integer by which it is meaſured, that quantity being multiplied by the ſame rate produceth the value required.*

Queſtions of practiſe which concerne things meaſured.

1 *Example*, I demand the *value* of 3, *lib.* 5, *ounc.* of gold plate (*Troy Waight*) at 40. *l.* the *lb.* here the certain *quantitie*, whoſe *value* I deſire to know, is 3, *lb*, 5, *ounc.* of Gold Plate, and the *Integer*, by which the ſame *quantity* is meaſured, is the *lb. Troy*, whoſe rate is propounded to be 40, *l.* I *ſay* then, if you multiply 3, *lb.* 5, *ounc.* by 40, *l.* the *product* will be the *value* of the 3, *lb.* 5, *ounc.* of Gold Plate according to the *rate* of 40, *l.* the *lb Troy:* wherefore to give *anſwer* to this queſtion, firſt reduce (by the Tablet of *Troy waight*, and according to the directions given you in the 16 rule of the 12 chapter of the 1 book) the 3, *lb.* 5 *ounc.* to 3.41 66. This done, if you proceed according to

1 By Troy waight.

the

the 4 rule of this chapter, you ſhall finde the *product* to be 136 66: now this *product* being reduced to *l. s.* and *d.* (by the 18 rule of the 12 chapter of the 1 booke) is 136,l. 13,s. 4,d. which is the *Facit*, or reſolution of the queſtion propounded, for ſo much is the true *value* of 3.*lb.* 5 *ounc.* of Gold Plate at the *rate* of 40, *l.* the *lb.*

3,*lb.* 5 *ounc.*	3.41666	0.53357
40,*l.*	40.	1.60206
136,*l.* 13,s. 4,d.	136.66	2.13563
	65	
	01	

2 What is the *value* of 2,*lb.* 4,*ounc.* 6,*p.* 15.*gr.* of Gold plate at 37,l. 17.s. 10.d. the *lb*? here firſt reduce (by the 16 rule of the 12 chapter of the 1 book) the 2,*lb.* 4,*ounc.* 6,*p.* 15,*gr.* to 2.36093 as alſo the 37,l. 17,s. 10,d. to 37.8916; and then proceeding as in the former *example*, you ſhall finde the product, or *facit* of the demand to be 89,l. 9,s 1,d.

2.4.6.15.	2.3609	0.37307
37.17.10.	37.8916	1.57854
89.9.1.	89.454	1.95161
	45	
	004	

3 What

3 What is a wedge of gold *worth*, that weigheth 4, *ounc.* 6, *p.* 15, *gr.* at 37, l. 17, s. 10, d. the *lb*? Here proceed according to to 5 rule of this chapter. And so you shall finde the *Facit*, 13, l. 13, s. 6, d. 1, f.

4.6.15.	.36093	0.44256
37.17.10.	37.8916	1.57854
13.13.6.1.	13.676	—1.13598
	65	
	026	
	025	
	001	

4 What is an ounce of Gold *worth* at 37, l. 17, s. 10, d. the *lb*? *Facit* 3, l. 3, s. 1, d. $3\frac{4}{10}$ f.

1 *ounce.*	.083333	—1.07918
37.17.10.	37.8916	1.57854
3.3.1.3 $\frac{4}{10}$	3.1576	0.49936
	15	
	0076	
	0041	
	0035	
	0031	
	0004	

5 What

5 What is a penny waight of Gold *worth* at 37,l. 17,s. 10,d. the *lb* ? *Facit* 3,s. 1,d. $3\frac{59}{1041}$f.

1,*p.*	.0041666	—2,38023
37.17.10.	37.8916	1,57854
3.1.$3\frac{59}{1041}$	.15787	—0,80169
	15	19831
	00787	
	00416	
	00371	
	00312	
	00059	

6 What is a graine of Gold *worth* at 37,l. 17,s. 10,d. the *lb* ? *Facit* 1,d. $2\frac{329}{1041}$f.

1,*gr.*	.00017361	—3.76043
37.17.10.	37.8916	1.57854
1,$2\frac{329}{1041}$	.006578	—2.18189
	004166	81811
	002412	
	002083	
	000329	

7 What

7 What is the *value* of 32,*lb*.7,*ounc*. 3 *p*. 19,*gr*. of Gilt plat at 4,l. 11,s. 9,d. the *lb*. ? *Facit* 149,l. 10,s. 11,d.

32.7.3.19.	32.599	1.51320
4.11.9.	4.5875	0.66158
149.10.11.	149.54	2.17478
	5	
	04	

8 What are 37, *ounc*. 17. *p*. 10 *gr*. of white plate *worth*, at 3,l. 6,s. 8,d. the *lb*. here first reduce the 37, *ounc*. into *lb*. and *ounc*. *viz*. dividing them by 12, the number of *ounces* contained in a *lb*. this done, 37, *ounc*. 17, *p*. 10 *gr*. will be converted into 3, *lb*. 1, *ounc*. 17, *p*. 10, *gr*. and then proceeding as before, you shall finde the *Facit* 10,l. 10,s. 4. 3,f.

3.1.17.10.	3.1559	0.49911
3.6.8.	3.3333	0.52287
10.10.4.3.	10.519	1.02198
	5	
	019	
	016	
	003	

9 What

9 What is the *price* of 8 *ounc.* 0 *p.* 11 *gr.* of gilt plate at 4 *l.* 10 *s.* the *lb*? *Facit* 3 *l.* 0 *s.* 2 *d.* $0\frac{2}{10}$ *f.*

8.0.11.	.66857	—0.17486
4.10.	4.5	0.65320
3.0.2.$0\frac{2}{10}$f	3.0085	0.47834
	0083	
	0002	

10 What is the *value* of 11, *ounc.* 3, *p.* of white plate at 3 *l.* 8 *s.* 5 *d.* the *lb*? *Facit* 3 *l.* 3 *s.* 6 *d.* $3\frac{4}{10}$ *f.*

11.3.	.92916	—0.03190
3.8.5.	3.4208	0.53412
3.3.6.$3\frac{4}{10}$	3.1785	0.50222
	15	
	0285	
	025	
	0035	
	0031	
	0004	

11 What is an ounce of Silver *worth*

at

at 3,l. 6,s. 8,d. the *lb*? *Facit* 5,s. 6,d. $\frac{69}{104}$f.

1,ounce	,083333	—1.07918
3.6,8.	3.3333	0.52287
5.6.2$\frac{69}{104}$f.	·27777	—0,55631
	25	44369
	02777	
	025	
	00277	
	00208	
	00069	

12 What is a penny waight of Silver *worth* at 3,l. 6,s, 8,d. the *lb*? *Facit* 3,d. 1$\frac{347}{1041}$f.

1,p.	,0041666	—2.38023
3.6,8.	3.3333	0.52287
3. 1$\frac{347}{1041}$	.013888	—1,85736
	0125	14264
	001388	
	c01041	
	000347	

13 What

13 What is a grain of Silver *worth* at 3,l. 6s. 8,d. the *lb.*? *Facit* $0_{\frac{5787}{16416}}$f.

1,gr.	,00017361	—3.76043
3.6.8.	3.3333	0.52287
$0,0_{\frac{5787}{134^{1}6}}$	,0005787	—3.23756
		76245

14 What is the *price* of 5,*C*. 3,*qu* 17,*lb*. of Corence at 1,l. 13,s. 4,d. the *C*. Here reduce the 5,*C*. 3,*qu*. 17,*lb*. (by the Tablet of *Averdupois* great waight, and according to the directions given you in the 16 rule of the 11 chapter of the 1 book) to 5,90178, and then proceeding as in the former *examples* you shall finde the *Facit* to be 9,l. 16,s. 8,d. 2,f. which is the true *value* of the 5,*C*. 3,*qu*. 17,*lb*. of Corence at 1,l. 13,s. 4,d. the *C*. 2 By Averdupois great waight.

5.3.17.	5.90178	0.77100
1.13.4.	1.66666	0.22180
9 16.8.2.	9.835	0 99280
	8	
	035	
	033	
	002	

15 What

Tare is that wherein any thing is put, as a bag for Pepper, a cheſt for Sugar, &c.

15 What is the *valu* of a bag of Pepper, that weighes (beſides the *tare*) $8\frac{1}{2}$ *C.* 12,*lb.* 7,*ounc.* at 10,l. 5,s. 7,d. the *C?* *Facit* 88,l. 12,s.

8.2.13.7.	8.6199	0,93550
10.5.7.	10.279	1,01195
88.12.	88.16	1,94745

16 What is a cheſt of Sugar *worth*, that weighes $7\frac{1}{3}$ *C.* $19\frac{1}{4}$ *lb.* at 6,l. 3,s. 4,d. the *C?* *Facit* 47,l. 6,s. 2,d. 1,f.

17 What are $0\frac{3}{4}$ *C.* 25,*lb.* $7\frac{1}{4}$ *ounce.* of any thing *worth*, At 27,s 5,d. or 1,l. 7,s. 5,d. the *C.?* *Facit* 1,l. 6,s. 9,d. 2,f.

18 What are 11,*lb.* $0\frac{3}{4}$ *ounc.* worth at 17,s. 9 d. the *C?* *Facit* 1,s. 9, d.

19 What is $\frac{1}{4}$ *C.* of *Tobacco* worth, at 50,l. 7,s. 8,d. the *C.?* *Facit* 12,l. 11,s. 11,d.

20 A Barrell of *Gunpouder* is bought after the *rate* of 5,l 11,s. 10,d. the *C.* at what *rate* may a *pound* of that *Gunpouder* be afforded? *Facit* 11,d. $\frac{965}{1021}$ f.

21 What is the *price* of an *ounce* of *Mace*, at 7,l. 18,s. 6,d. the *C.?* *Facit* 9,d. 2,f.

22 What

22 What is the *value* of 89,*lb*. 4,*ounc*. of *Cloves*, at 6,s. 4,d. the *lb*. Here reduce (by the Tablet of *Averdupois little waight*) the 89,*lb*. 4,*ounc*. to 89.25; This done, if you finish the *operation*, as in the former *examples* you shall finde the *Facit* to be 28,l. 5,s. 3,d. 3 By Averdupois little waight.

89.4.	82.25	1.95060
6. 4.	.31666.	—0.49941
28.5. 3.	28. 262	1.45119

23 What are 57,*lb*. 15,*ounc*. 5,*dram*. of *Silke* worth, at 32,s. 7,d. 1,f. the *lb*? *Facit* 94,l. 9,s. 8,d.

24 What is the *value* of 20 *Tod*, and 2 *pounds*, at 10,d. 2,f. the *lb*. when a *Tod* consists of 28, *lb*? Here convert the 20 *Tod* into *pounds*, *viz* by multiplying the 20 *Tod* by 28, the number of *pounds* contained in a *Tod*; for 560, being the *product* of those two numbers, is the number of *pounds* contained in the 20 *Tod* propounded, unto which if you add the *two odd pounds*, the *Totall* is 562 *lb*: Now then 562 being multiplied by 10,d. 2,f. the *rate* of

one *pound*, produceth 24,l. 11,s.9 the *value* required.

25 What do 30 *Stone*, $8\frac{3}{4}$ *pounds* amount unto, at 3,d. 1,f. the *lb*. when 14,*lb*. maketh a *Stone*? Here multiplie the 30 *Stone* into ſingle pounds (*viz*. by 14) which produceth 420, whereunto if you add $8\frac{3}{4}$ the *ſum* is $428\frac{3}{4}$ or 428.75; this done, proceeding *as before*, you ſhall finde the *Facit* 5,l. 16,s. 1,d. 1,f.

26 What do 45 *Stone* $3\frac{1}{4}$ *pounds* come to: at 2,d. 3,f. the *lb*. when eight *pounds* are accounted for a *Stone*? Here multiply the 45 *Stone* into *pounds* (*viz*. by 8) and then proceeding, *as before*, you ſhall finde the *Facit* 4,l. 3,s. 6,d.

27 What is the *price* of $13\frac{1}{4}$ *ounc*. or (which is all one) 13,*ounc*. 4,*drams* of *Cinamond*, at 6,s. 2,d. the *lb*? *Facit* 5,s. 1,d. $1.\frac{15}{128}$f.

28 What are 7, *ounc*. $11\frac{3}{4}$ *dram*. of *Ambergreeſe* worth at 84,l. 16,s. 8,d. the *lb*? *Facit* 41,l. 0,s. 1,d. 2,f.

29 A parcell of *Ambergreeſe* is bought at the *rate* of 84,l. 16,s. 8,d the *lb*. what is that the *ounce*? *Facit* 5,l. 6,s. 0,d. 2,f.

30 A certain quantity of *Muske* is bought at the *rate* of 58,s. 3,d. the *lb*. how may

may a *dram* thereof be afforded, according to the ſame *rate*? *Facit* 2,d. $2\frac{960}{1041}$f.

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31 What is a *Tun* of *Wine* worth at the *rate* of 4,s. 1,d. the *Gallon*? Becauſe a *Tun* of *Wine* contains 252 *Gallons* (as may be collected by the 40 rule of the 1 chapter of the 1 book) therefore here I multiply the ſame 252 by 4,s. 1,d. the *given rate*; this done, the *Facit* or Reſolution of the *Queſtion* is 51,l. 8,s. 10,d. 4 By Liquid meaſures.

1. *Tunne*	252.	2.40140
4. 1.	.204166	—0.69c03
51. 8. 10.	51.44	1.71137

32 What is the *value* of a *Pipe* of *Oyle*, which contains 122, *gallons*, 5, *pints* at 3,s. 5,d. 1,f. the *gallon*? Here reduce (by the Tablet of *Liquid meaſures*) the 122, *gall.* 5, *pints* to 122.625, and then proceeding as in the former *operation* you ſhall finde the *Facit* 21,l. 1,s. 6,d. 2,f.

33 What is the *price* of a *Rundlet* of *Wine* that containes 13 *gallons* $3\frac{1}{2}$ *pints* at 4,s. 3,d. 3,f. the *gallon*? *Facit* 2,l. 17,s. 11,d. 1,f.

34 A *Pipe* of *Canary* is bought at the *rate* of 3,s. 9,d. 2,f. the *Gallon*, what is that the *Pint*? *Facit* 5,d. $2\frac{782}{1641}$f.

5 By dry measure.

35 Unto What ſum amount 47 *quarthers*, 5 *buſhels*, and 3 *pecks* at 32,s. 10.d. the *quarter*? Here reduce (by the Tablet of *Drie meaſures*) the 47,*qu*. 5,*bu*. 3,*pe*. to 47·718? And then vvorking *as before*, the *Facit* will prove to be 78,l. 6,s. 8,d.

47· 5· 3·	47·718	1.67869
1. 12. 10.	1.64166	0.21527
78. 6. 8.	78.33	1.89396

36 What is the price of 10 *Chalders*, 2 *quarters*, 7 *buſhels*, and $3\frac{1}{3}$ *pecks*, at 8,s. 4,d. 2,f. the *quarter*? Here multiply the 10 *Chalders* into *quarters*, *viz*. by 4 (for ſo many *quarters* are contained in a *Chalder* by the 41 *rule* of 1 chapter of the 1 book.) This done, your termes propounded are 42,*qu*. 7,*bu*. $3\frac{1}{3}$*pe*. and 8,s. 4,d. 2,f. vvhich if you multiply together, as in the former *Example*, you ſhall finde the *Facit* 18,l. *feré*.

37 What are 6,*bu*. $1\frac{1}{4}$ *pe*. 3, *pintes* of *wheat* worth, at 32,s. 10,d. the *quarter*? *Facit* 1,l. 6. s. 1,d, 0 $\frac{3}{10}$f.

38 A *Merchant* buyes a parcell of *Rie* at

at 23,s. 5,d. the *qu.* how may a *buſhell* of that *Rie* be afforded, according to the ſame *rate*? *Facit* 2,s. 11,d. $0\frac{52}{104}$f.

39 A *Chandler* buyes *oates* at 12,s. 6,d. 3,f. the *qu.* what is that the *Pecke*? *Facit* 4,d. $2\frac{88}{104}$f.

40 A *Chandler* buyes a parcell of *Muſtardſeed* at 48,s. 8,d. the *quarter*, what is that the *Pint*? *Facit* 1,d. $0\frac{586}{1041}$f.

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41 A *Linnen Draper* buyes ſeven pieces of *Holland* that contain together $205\frac{3}{4}$ *Ells*, 2 *Nailes*, at the *rate* of 3,s. 2 d. 2,f. the *Ell*; what come they to all together at that *rate*? Here change the $205\frac{3}{4}$ *Ells*, 2 *Nailes* (by the Tablet of *long meaſures*) to 205.875; and then proceeding, as *before*, you ſhall finde the *Facit* to be 33,l. 0,s. 6,d. 2,f. 6 By long meaſure

$205\frac{3}{4}$El.2,n.	205.875	2.31360
3.2.2.	.160419	—0.79475
33,0.6.2.	33.027	1.51885

42 A *Taylor* buyes $8\frac{1}{4}$ *yeards*, $3\frac{1}{2}$ *nailes* of *Pluſh* at 1,l. 4,s. 9,d. the *ye*. what comes that to? *Facit* 10,l. 9,s. 8,d.

43 What is the *price* of $\frac{3}{4}$*El*. $1\frac{1}{4}$ *nail* of *Taffaty* at 12,s. 10,d. the *El*? *Facit* 11,s. 0,d. 1,f.

44 What is the *price* of $\frac{1}{3}$ *ye.* $3\frac{1}{4}$ *nai.* of *Scarlet* at 3,l. 5,s. 5,d. the *yeard*? *Facit* 2,l. 5,s. 11,d. $3\frac{8}{15}$f.

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7 By time.

45 How much is due for a *Schollers diet* in 5 *yeares*, 3 *moneths*, and 17 *dayes* at the *rate* of 6,l. 13,4,d. *per annum*? Here reduce (by the Tablet of *Time*) 5, *ye.* 3, *mo.* 17, *d.* to 5.2965, and then working, *as before*, you shall finde the *Facit* to be 35,l. 6,s. 2,d. 2,f.

5. 3. 17.	5.2965	.0.72398
6. 13. 4.	6.6666	0.82390
35. 6. 2. 2.	35.31	1.54788

46 How much *pay* is due to a *Collonel* for 7, *mo.* 21, *da.* at the *rate* of 825, l. 15, s. 6, d. *per annum*? *Facit* 529, l. 4, s.

47 A *Noble man* spends in *housekeeping* 932, l. 18, s. 10, d. *per annum*, what is that the *moneth*, consisting of 28 *dayes*? *Facit* 71, l. 11, s. 6, d.

48 How much is that the *Weeke*, or 7, *dayes*? *Facit* 17, l. 17, s. 10, d.

49 The *King* of *France* retaines in *continuall pay* 50000 *Souldiers*, which costs him

him 517325,l. *ſterling per annum*, how much is that the day? *Facit* 1417,l. 8,s.

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8 By the Dozen.

50 What coſts 5 *groſſe*, 7 *dozen*, and 5 *paire* of *Gloves* at 6,l. 13,s. 4,d the *Groſſe*? Here reduce (by the Tablet of *Dozens*) 5 *gr.* 7 *doz.* 5 *pai.* to 5.618, and then finiſhing the *Operation*, you ſhall finde the *Facit* to be 37,l. 9,s. 1,d.

5. 7. 5.	5.618	0.7496
6.13.4.	6.6666	0.8239
37. 9.1.	37.454	1.5735

51 What is the *price* of 10, *doz.* and 7 *ſilver-plate buttons* at 53,s. 9,d. the *groſſe*? *Facit* 2,l. 7,s. 5,d. *Ferè*.

52 One buyes a *Box* of *Lute-ſtrings* at 31,s. 6,d. the *groſſe*, what is that the *Dozen*? *Facit* 2,s. 7,d. 2,f.

53 One buyes a parcell of *ſilver-plate buttons* at 53,s. 9,d. the *groſſe*, what is that the *Button*? *Facit* 4,d. $1\frac{956}{1344}$ f.

Reduction. 1 Of coine current in England to Engliſh money.

54 Unto what ſum in *ſterling* money do 307¼ *Thirteen-pence-halfe-penies* amount at 1,s. 1,d. 2,f. a peece? *Facit* 17,l. 5,s. 8,d. *ferè*.

307 ¼	307.25	2.48749
1.12.	.05625	—1.24988
17.5.8.	17.283	1.23761

55 How much are 1025½ *Harpers*, at 9,d. a piece? *Facit* 38,l. 9.s. 1,d. 2,f.

56 Unto how much *ſterling* money do 237 *foure-pence-halfe-pennies* amount, at 4, d. 2,f. a piece? *Facit* 4,l. 8,s. 10,d. 2,f.

57 How much *ſterling* money are 237 *Ryders*, at 21,s. 2,d. 2,f. the *Ryder*? *Facit* 251,l. 6,s. 8,d.

2 Of French money to Engliſh money.

58 Unto how much *ſterling* money do 1234 *Francs*, or pounds *Tournois* amount, at 2,s. *ſterling* the pound *Tournois*? *Facit* 123,l. 8,s. *ſterling*.

1234,l. *Tour.*	1234.	3.09132
2,s. *ſt.*	.1	—1.00000
123,l. 8,s. *ſt.*	123.4	2.09132

59 How much do 1942,l. 7,s. 4,d. *tourn.*

tourn. amount unto, in *sterl.* money, at 2,s. *sterling* the pound *tourn* ? Becauſe the l. *tourn.* is divided, as is the l. *sterling*, *viz.* firſt into 20 *ſons*, and then each *ſons* into 12 *denires*, the Tablet of *money* (produced in the 6 chapter of this book) will likewiſe ſerve for the *Reduction* of the s. and d. thereof into *Decimals*; And therefore 1942,l. 7,s. 4,d. *tour.* after *Reduction* is 1942.36666. This done, and the reſt of the *operation* finiſhed, I finde the *Facit* to be 194,l. 4,s. 8,d. *sterling*.

60 You may *obſerve* by theſe two laſt *examples*, that the pound *tourn.* is valued at 2,s. *sterl* being the tenth part of a pound *sterling*. And therefore for a more ready and exact *Reduction* of that kinde of money into *sterling* money, you may proceed thus: firſt change the *Fraction* annexed unto the l. *tour.* (if any be) into a *Decimal*, and then remove the *point* one place back towards the *left hand*: for, this done, the *Reduction* is performed: So in the *example* laſt premiſed, 1942,l. 7,s. 4,d. *tour.* being firſt made 1942.3666, and then 194.23666 repreſents in *sterling* money 149,l 4,s. 8,d. $3\frac{21}{84}$f. which yieldeth you $3\frac{21}{84}$f. more then the former way of *working* the ſame *queſtion*.

An eaſier, and more exact way of reducing French money into Engliſh.

61 Upon

3 Of French Coine to Englſh money.

61 Upon the ſame ground may you likewiſe diſcover how much any Coine (currant in France) is worth in Engliſh money, the value of the ſame Coin in French money being firſt propounded. *Example*, A Spaniſh Piſtolet is valued at this day in *Paris* at 7,l.6,s. *tourn.* whereupon I demand the value of the ſame piece in *ſterling* money: To reſolve this *Queſtion*, you are firſt to reduce (as before) the 7,l. 6,s. *tourn.* to 7·3, and then by ſetting that number one place back towards the right hand you are to make it ·73, which being reduced to Engliſh money is 14,s. 7,d. $0\frac{833}{1000}$f. *ſterling*, *viz.* the value of a Spaniſh Piſtolet at *Paris* in *ſterling*, or Engliſh money.

62 Again, an *Eſcu d' or* (that is, a French Crown of Gold) being valued in *France* at 3,l. 16,s. *tourn.* what is the ſame piece worth in *ſterling* money? *Facit* 7,s. 7,d. $0\frac{833}{1000}$f. *ſterling*.

63 A *Quart d' Eſcu* being eſtimated in *France* at 16,s. *tourn.* what is the value of the ſame piece in *ſterling* money? *Facit* 1,s. 7,d. $0\frac{833}{1000}$f.

64 Unto how much *ſterling* money do 49 *Spaniſh Piſtolets* amount at 7,l 6,s. *tourn.* the *Piſtolet*? Here firſt reduce (according

cording to the 61 example of this rule) the 7,l. 6,s. *tourn.* to 73 *ſterling*. This done, and the termes multiplied together, you ſhall finde the *Facit* 35,l. 15, s. 6.d. *ſterling*.

65 How much ought I to receive at *London* in *ſterling* money for 189 *Eſcues d' or* delivered in *Paris* at 3,l, 16,s. *tourn.* a piece? *Facit* 71,l. 16,s. 6,d. *ſterling*, *ferè*. *Vide ſupra exam.* 62.

66 How much *ſterling* money ought I to recive for 468 *Quart d' Eſcus* at 16,s. *tourn.* the peice? *Facit* 37,l. 8,s. 10,d. *ſterling ferè*. *Vide ſupra exam.* 63.

67 Unto how much *ſterling* money do 189 *Eſc. d' or*, and 468 *Quart d' Eſcus* amount? *Facit* 109,l. 5,s. 4,d. *ſterling Cauſa patet*.

71. 16. 06.
37. 08. 10.

109. 05. 04.

68 A *Gentleman* intending to travell into *Frante* receives of a *Merchant* 650 light *French crownes* at 6,s. 1,d. 2,f. *ſterling* a piece, what is the *Gentleman* to pay in *ſterling* money for the ſame *crownes*? *Facit* 199,l. 1,s. 3,d, *ſterling*.

69 Unto

4 Of coin currant in France to French money.

69 Unto how many *Francs*, or l. *tourn.* do 204½ *Spaniſh Piſt.* amount at 7,l. 6,s. *tourn.* a piece? *Facit* 1492 l. 16,s *tournois, ferè.*

70 Unto how much *French* money doe 189 *Eſcus d' or* amount at 3,l. 16,s. *Tournois*, the piece? *Facit* 718, l. 4,s. *tournois*.

71 What do 468 *quart d' Eſcus* amount unto in *French* money, at 16,s. *tournois*, a piece? *Facit* 374,l. 8,s *tourn.*

5 Of Engliſh money to Flemiſh.

72 VVhen the Exchange from *London* to *Middleborough* is at 1,l. 5 s. 9,d. *Flemiſh* for 1,l. *ſterling*, how much ought I to receive in *Flemiſh* money at *Middleborough* for 103,l. 7,s. 8.d. *ſterling*, delivered in *London*? *Facit* 133,l. 2,s. *Flem.*

6 Of Ducats to Engliſh money.

73 Unto how much *ſterl.* money do 324 *Ducats* amount, at 7,s. 5,d. *ſterl.* the piece? *Facit* 120, l. 3,s. *ſterl.*

7 Of Dolers

74 How much *ſterl.* money do 447 *Dollers* amount unto at 4,s. 4,d. *ſterl.* the piece? *Facit* 96,l. 17,s. *ſterl.*

8 Of Florins.

75 How much *ſterl.* money are 447 *Florins* at 3,s. 2,d. *ſterl.* the *Florin*? *Facit* 70,l. 15,s. 6,d *ſterl.*

VIII.

VIII. *The Content of a Rectangle superficies is discovered by multiplying the length by the breadth, for the product thereof is the superficiall content required.* *Vide supra l. 3. c. 5. 3. 5.*

I. *Example*, A board being 8 *foot*, 5 *inches* long, and 1 *foot*, $2\frac{1}{2}$ *inches* broade, how many *square feet* are contained in it? Here 8 *foot*, 5 *inches* (the length) being multiplied by 1 *foot*, $2\frac{1}{2}$ *inches* (the breadth) produce 10 *foot*, $2\frac{3}{83}$, *inches*, the *superficiall content* demanded. Questions of things measured. 1 By the foot

8. 5.	8.41666	0.92514
1. $2\frac{1}{2}$	1.20833	0.08215
10. $2\frac{3}{83}$	10.169	1.00729
	166	
	003	

Touching this *Example* observe, that, in the *Tablet* of *Dozens*, 41666 may be conceived a *Decimal* representing 5 *inches*: likewise 20833 being compounded of 16666, the *Decimal* of 2 *dozen*, and 04166 the *Decimal* of 6 particulars or $\frac{1}{2}$ *doz.* represents $2\frac{1}{2}$ *inches*. See the conclusion of the last chapter.

2 A boord being $9\frac{32}{100}$ or 9.32 *foot* in length, and $0\frac{84}{100}$ or .84 *foot* in breadth, what is the *superficiall content* thereof? *Facit* $7\frac{829}{1000}$ or (which is all one) 7.829 *foot*.

9.32	0.96944
.84	—0.07571
7.829	0.89373

3 What is the *superficiall content* of 7 Plankes, which having *equall breadth*, viz. .92 *foot* containe in *length*, being accounted all together 65.17 *foot*? *Facit* .59.96 *foot*.

4 Having a *chamber* to floore, which is 17.19 *foot* long, and 14.35 *foot* in breadth, I demand how many *foot* of *board* are necessary for that purpose? *Facit* 246.69 *foot*.

2 By the Yeard.

5 How many *square yeards* are contained in a peece of *Tapistry* $3\frac{1}{4}$ *yards* $1\frac{1}{2}$ *nai.* long, and $2\frac{1}{3}$ *yards* $3\frac{1}{4}$ *nai.* broad? *Facit.* 9, *year.* $0\frac{1}{2}$ *nai.*

$3\frac{1}{4}$	$1\frac{1}{2}$	3.34375	0.52422
$2\frac{1}{3}$	$3\frac{1}{4}$	2.70312	0.43186
9.	$0\frac{1}{2}$	9.038	0.95608

6 How

6 How many *ſquare yeards* of *wainſcot* are there contained in a *Parlor*, when the circuit thereof is 22 *yeards* 3, *qu.* 1, *nai.* and the *height* $3\frac{1}{3}$ *yeards* $2\frac{1}{2}$ *nai*? *Facit* 83, *yeards* 1, *qu.* $2\frac{3}{4}$ *nai.*

7 How many *ſquare rods* are contained in the *ridge* of an *houſe* which is 6 *rod* 7 *foot* long, and 4 *rod* $6\frac{26}{100}$ *foot* over, when the *rod* is 10 *foot* in length? *Facit* 30 *rod* $9\frac{95}{100}$ *foot.* 3 By the Rod

6.7	6.7	0.82609
$4.6\frac{26}{100}$	4.626	0.66520
$30.9\frac{95}{100}$	30.995	1.49129

8 How many *tiles* are requiſite to cover ſuch a *ridge*, when every *rod ſquare* will tak up 1000 *tile*? *Facit* 30995 *tile.*

9 How many *roods* are contained in a *brick wall* being 6 *roods*, 5 *foot*, 7 *inches* long; and 9 *yards* 1, *qu.* $2\frac{1}{2}$ *nai.* in height, when 7 *foot* in *length*, and 3 *foot* in *height* are accounted a *rood* of *wall*? *Facit* $63\frac{155}{200}$ *rood.* 4 By the Rood.

Vide l.2.c.6. r.6.

$6\frac{5}{7}\ \frac{7}{12}$	564	2.75128
	84	1.92428
		0.82700
9.1. $2\frac{1}{2}$	9.4062	0.97341
$63\frac{155}{1000}$	63.155	1.80041

10 How many *bricks* are necessary to make up such a *wall* when every three *rood* of *wall* (being $1\frac{1}{2}$ foot thick) takes up 1000 *brickes? Facit* 21051.

And *thus* also may you discover how many *bricks* are requisite for the *intire building* of an *house* before you begin it.

63155
21051

5 By the chaine.

11 How many *Acres* are there contained in a *piece of ground* which bearing the forme of a *long square* is 22 *Chaine* 50 *linkes* in length, and 15 *Chaines* 25 linkes in breadth; or (which is all one) 2250 *linkes* long, and 1525 *linkes* broad? In the resolution of this *question* having multiplied the *termes propounded* you are to cut off from their product *five figures* towards the *right hand*, for then the figures *remain-*

See this kinde of chaine mentioned in the conclusion of the last chapter.

remaining towards the *left hand* being 34 are the required quantity of *Acres*, and the figures so cut off are a *decimal* representing the fraction of an *Acre*, which you may easily reduce into *Poles*, if you multiply the first *two figures* thereof by 6, and setting the product thereof one place *backe* towards the right hand, add together the first *two places* of that product and *decimall* so ordered, as also an *vnit* when the figures of the *third place* exceed 5, as 2 and 6 in this case do; for that *sum* being 50 is the number of *Poles* required, which amounting to 1 *Rood*, and 10 *Poles*: I conclude that the *intire content* of that *ground* is 34 *Acres*, 1 *Rood*, and 10 *poles*: The *reason* of this *operation* I referre to the *Scrutinie* of the *Curious* till I may hereafter have *fitter opportunity* to expresse it more at large, see the *worke*.

2250.	3.35217
1525.	3.18327
34 31200.	6.53544 *Vide l. 2. c. 6. r. 10.*
186	
50	

12 A *Triangle* being propounded whose *base* is 3683 *linkes* and the *Altitude* or perpendicular 1759, what is the *superficiall content* therof in *Acres*? *Facit* 32, *acres*, 1 *rood*, 22 *poles*.

3683.	3.56620
1759.	3.23529
64.78000.	6.81149
32.39000.	
234	
62	

Questions of things measured.
1 By the foot See the 6,7, and 8, exam. of the 4 rule, and the last example of the 5 rule of this chap.

IX. *The Content of a Rectangle solid is discovered by the continuall multiplication of the length, breadth, and depth together; for the product thereof is the solid Content required.*

1 *Example*, How many *Cube feet* are contained in a piece of *Timber*, being 18.57 *foot* long, 1.67 *foot* broad; and 0.89 *foot* deep? *Facit* 27.601

18.57	1.26881
1.67	0.22271
	1.49152
.89	—0.05060
27.601	1.44092

2 How

2 How many *foot* of *Timber* are there in another piece that consisting likewise of 18.57 *foot* in length beares .89 *foot* square? *Facit* 14.71.

3 How many *Cube yeards* are there in a *bricke wall* 17, *yea.* 3, *qu.* 1, *nai.* long, 13, *yea.* 1, *qu.* high, and (one part thereof being considered with another) $0\frac{1}{2}$ *yea.* 2 *nai.* thicke? *Facit* 147, *yea.* 2 *qu.* $0\frac{1}{4}$ *nai.* 2 By the yeard.

17.3.1.	17.8125	1.25073
13.1.	13.25	1.12222
		2.37295
	.625	0.20410
147.2.$0\frac{1}{4}$	147.52	2,16885
	5	
	02	

4 How many *French Toises* are there in a *Rampart* $98\frac{5}{6}$ *Toises* long, $15\frac{1}{6}$ broad, and $3\frac{1}{2}$ deepe, the *French Toise* consisting of 6 foot *French*? *Facit* 5246, *ferè.* 3 By the Toise.

$98\frac{5}{6}$	95.833	1.99488.
$15\frac{1}{6}$	15.166	1.18087.
$3\frac{1}{2}$	3.5	0.54406.
5246.	5246.	3.71981.

In this *Example* yon may *reduce* $\frac{5}{6}$ and $\frac{1}{6}$ by the Tablet of *dozens*, for $\frac{5}{6}$ is *equivalent* to $\frac{10}{12}$ and $\frac{1}{6}$ to $\frac{2}{12}$

Chap. 8.

Division.

The use of Logarithmes in divisions.

I. *In Division by the Logarithmes, when the Dividend is greater then the Divisor the Logarithme of the Quotient is always perfect, & contrà.*

Because in *Division*, when the Logarithme of the *Quotient* is found, there may be some *difficulty* to discerne, whether it is a *perfect* or a *defective* Logarithme, it is here requisite to prefix this *Rule*, by which that doubt may be removed; for if you observe the three *proportionall* numbers given in every *division* you shall there finde this *proportion*.

As the Diviſor is to the Dividend;
So is 1 to the Quotient.

according to the 27 rule of the 20 chapter of the firſt book: I ſay therefore, when the *Dividend*, which is the *ſecond terme* is greater then the *Diviſor*, which is the *firſt terme*; The *Quotient*, which is the *fourth terme*, muſt needs be greater then 1, the 3 *terme*; And therefore in this caſe the Logarithme of the *quotient* is alwayes *perfect*, that is, the Logarithme of a whole or mixt number: Contrariwiſe, when the *dividend* is leſſe then the *Diviſor*, the *Quotient* is leſſe then 1, and therefore in this caſe the Logarithme of the *Quotient* is alwayes a *defective*, that is, the Logar. of a fraction, or broken number: This *rule* you ſhall finde ſufficiently illuſtrated by the *Examples* of theſe other *rules* that follow.

II. *Here when the Logarithmes of the numbers given are both of one, and the ſame kinde, ſubtract the leſſer out of the greater: which done, the reſidue is the Logarithme of the Quotient.*

See the 12 R. of the 2 cha. of this book. Examples,

1 *Example*, 1728 being given to be divided by 12, the *Quotient* is 144, for the Logarithme of 1728 by the 1 *rule* of the 6 chapter of this book is 3.23755, out of

1 Of two whole numbers.

which if you deduct 1.07919 the Logarithme of 12, the *remainder* is 2.15836, which by the 9 rule of the chapter last cited is the Logarithme of 144 the *quotient* required: And here in this *operation* you may observe, that 2.15836 the Logarithme found is *perfect*, because 1728 the *dividend*, is greater then 12 the *divisor*, according to the rule afore going.

Dividend	1728.	3.23755
Divisor	12.	1.07919
Quotient	144.	2.15836

2 *Example*, 12 being divided by 1728, the *quotient* is .006944, for here the *dividend* being lesse then the *divisor*, the Logarith. of the *quotient* is a *defective*, according to the rule last cited.

Dividend	12.	1.07919
Divisor	1728.	3.23755
Quotient	.006944	——2.15836
Complement		84264

2 Of two Mixt numbers.

3 *Example*, 77.7 divided by $4\frac{6}{13}$ gives you 17.268 in the *quotient*.

Divi-

Dividend	77.7	1.89046
Divisor	$4\frac{6}{12}$	0.65322
Quotient	17.268	1.23724

4 *Example*, $4\frac{6}{12}$ being divided by 77.7 the *quotient* is .05791.

Dividend	$4\frac{6}{12}$	0.65322
Divisor	77.7	1.89046
Quotient	.05791	—1.23724
Complement		76276

5 *Example*, 2072.2 being divided by 12, the *quotient* is 172.68. 3 Of a Mixt, and a whole Number.

Dividend	2072.2	3.31643
Divisor	12.	1.07919
Quotient	172.68	2.23724

6 *Example*, 12 being divided by 2072.2, the *quotient* is .005791.

Dividend	12.	1.07919
Divisor	2072.2	3.31643
Quotient	,005791	—2.23724
Complement		76276

7 *Exam-*

4 Of two fractions.

7 *Example*, $\frac{3}{4}$ being divided by .0375, the *quotient* is 20, For the Logarithme of $\frac{3}{4}$ is ——0.12494. which if you deduct out of 1.42597 the Logarithme of .0375, the *remainder* is 1.30103, which by the 10 rule of 6 chapter of this book is the Logarithme of 20: And here 1.30103 the Logarithme found is *perfect*, because $\frac{3}{4}$ the *dividend* is greater then .0375 the *divisor*, according to the first rule of this Chapter.

Dividend	$\frac{3}{4}$	——0.12494
Divisor	.0375	——1.42597
Quotient	20.	1.30103

8 *Example*, .0375 being divided by $\frac{3}{4}$ the *quotient* is .05.

Dividend	.0375	——1.42597
Divisor	$\frac{3}{4}$	——0.12494
Quotient	.05	——1.30103
Complement		69897

III. *When the numbers propounded are both of one kinde, Division may be also performed by Addition; for when they are both*

both whole or mixt, if instead of the Logarithme of the least of those numbers, you take the whole Arithmeticall Complement thereof (viz. of the Characteristique and all) and adding it to the Logarithme of the other given number, cut off from their sum the first figure towards the left hand, the figures remaining towards the right hand are the Logarithme of the Quotient.

So in the first example of the last Rule 8.92081 being the Arithmeticall Complement of 1.07919, if I add the same unto 3.23755, their summe is 12.15836, from which if I cut off 1 (the first figure towards the left hand) the remainder is 2.15836, which is the Logarithme of 144, the Quotient as before.

Dividend	1728.	3.23755
Divisor	12.	8.92081
Quotient	144.	1|2.15836

IV. *But when both the numbers propounded are fractions, if instead of the Logarithme of the greatest of those numbers you take the whole Arithmeticall complement thereof and adding*

adding it (as before) to the Logarithme of the other given number, cut off from their ſum the firſt figure towards the left hand, the figures remaining are the Logarithme of the Quotient, as is manifeſt by the operation following, being the 7 example of the 2 Rule aforegoing.

Dividend	$\frac{3}{4}$	——9.87506
Diviſor	.0375	——1.42597
Quotient	20.	1|1.30103

V. *When the Logarithmes of the numbers given are of divers kinds add them together, which done, the ſum is the Logarith. of the Quotient.*

Examples. 1 Of a whole number and a fraction.

1 *Example,* 108 being propounded to be divided by $\frac{3}{4}$ the *quotient is* 144.

Dividend	108.	2.03343
Diviſor	$\frac{3}{4}$	——0.12494
Quotient	144.	2.15836

2 *Example,* $\frac{3}{4}$ being divided by 108 the *quotient* is .006944.

Divi-

Dividend	¾	——0.12494
Diviſor	108.	2.03343
Quotient.	.006944	——2.15837
Commplement		84163

3 *Example*, 129.51 being divided by ¾ the *quotient is* 172.68.

Dividend	129.51	2.11230
Diviſor	¾	——0.12494
Quotient	173.68	2.23724

4 *Example*, ¾ being divided by 129.51 the *quotient is* .005791.

Dividend	¾	——0.12494
Diviſor	129.51	2.11230
Quotient	.005791	——2.23724
Complement		76276

This rule is the inverſe of the 7 rule of the laſt chapter. Queſtions of practice which concerne things meaſured, 1 By Troy weight.

VI. *The value of any certain quantity being divided by the ſame quantity preſents in the Quotient the rate of the Integer, by Which that quantity is meaſured.*

1 *Example*, A Goldſmith buyes 3 *lb.* 5, *ounc.* of gold plate (*Troy weight*), for 136 l.

136,l. 13,s. 4,d. what is the *value* or rate of a *pound* of that Gold? Here the certain *quantity* propounded is 3,*lb.* 5, *ounc.* of Gold plate, and the *value* of the same quantity is 136,l. 13,s. 4,d. now the *question* is what a *pound* of that Gold plate is *worth?* wherefore (according to the 2 rule of this chapter) I divide 136,l. 13,s. 4,d. by 3,*lb.* 5,*ounc.* and finde in the *quotient* 40,l. which I conclude to be the *value* or rate of *a pound* of the same Gold-plate.

136.	13. 4.	136.666		2.13563
3.	5.	3.4166		0.53357
40.		40.		1.60206

2 *Example*, 37, *ounc.* 17, *p.* 10.*gr.* of vvhite plate cost 10,l. 10,s. 4,d. 3,f. what is that the *lb. I acit* 3,l. 6,s. 8,d.

3 If a wedge of gold, that weighed 4,*ounc.* 6,*p.* 15,*gr.* cost 13,l. 13,s. 6,d. 1,f. vvhat vvill a *lb.* of the same gold cost? *Facit* 37,l. 17,s. 10,d.

4 If an *ounce* of silver be worth 5,s. 8,d. 3,f. vvhat vvill a *lb.* of the same silver cost? *facit* 3,l. 8,s. 9,d *ferè.*

5 If

5 If a *Peny weight* of gold be worth 3,s. 6,d. 2,f. what is a *lb.* of the same gold worth? *Facit* 42,l. 10,s. 0,d. 2,f.

6 If a *grain* of gold be worth $1\frac{1}{3}$d. what is a *lb.* of the same gold vvorth? Here before you can resolve this *question* you must first reduce $1\frac{1}{3}$d. into his proper *decimal*; Novv as for the *decimall* of 1,d. it is .0041666, by the 15, rule of the 12, chapter of the 1 book; and because unto .0041666 the *decimal* of 1,d. you are yet to adde tvvo *third parts* of the same *decimal* answverable to $\frac{1}{3}$d. take the *third part* of .0041666. *viz.* .0013888 and double it, This done, you shall finde .0027776 to be the *decimal* answverable to $\frac{1}{3}$d. vvhich if you add unto .0041666 the *decimal* of 1 d. their *summe* is .0069442, *viz.* the correspondent *decimal*, of $1\frac{1}{3}$d. having thus converted $1\frac{1}{3}$d. into a *decimal* if you proceed as in the former *examples* you shall finde the *Facit* to be 40,l.

$1\frac{1}{3}$d.	.0069442	2.15837
1 gr.	.00017361	3.76043
40,l.	40.	1.60206

7 If

2 By Averdupois great weight.

7 If 8, *C.* 2, *qu.* 13, *lb.* 7, *ounc.* coſt 88, l. 12, s. what will 1, *C.* coſt? *Facit* 10, l. 5, s. 7, d.

8 If 0, *C.* 3, *qu.* 25, *lb.* $7\frac{1}{2}$ *ounc.* coſt 1, l. 6, s. 9, d. 2, f. what will 1, *C.* coſt? *Facit* 1, l. 7, s. 5, d.

9 If a *lb.* of any commodity coſt 1, s. 1, d. 2, f. what will a *C.* of the ſame coſt? *Facit* 6, l. 5, s. 9, d. 2, f.

10 What is the price of a *C.* of Mace, when the *ounce* coſt 9, d. 2, f? *Facit* 70, l. 18, s. 6, d.

3 By Averdupois little weight.

11 If 57, *lb.* 15, *ounce.* 5, *drames* of Silk coſt 94, l. 9, s. 8, d. what is a *lb.* of the ſame Silke worth? *Facit* 1, l. 12, s. 7, d. 1, f.

12 If 7, *ounc.* $11\frac{3}{4}$ *dram*, coſt 41, l. 0, s. 1, d. 2, f. what is a *lb.* worth? *Facit* 84, l. 16, s. 8, d.

13 What is a *lb.* worth, when the *ounc.* is ſold for 5, l. 6, s. 0, d. 2, f.? *Facit* 84, l, 16, s. 8, d.

14 If a *dram* of Muske coſt 3, d. what is a *lb.* of the ſame worth? *Facit* 3, l. 4, s.

15 What

4 By liqu^d measures.

15 What is the price of a *Gallon* of Wine, when the *Tun* coſt 51,l. 8,s. 10,d. *Facit* 4,s. 1,d.

16 If a *pint* of Wine coſt 3,d. 3,f. what is the price of a *Gallon* of the ſame wine? *Facit* 2,s. 6,d.

---

5 By dry measures.

17 *Example*, 47, *quarters*, 5 *buſh.* and 3 *pecks* are bought for 78,l. 6,s. 8,d, what is that the *quarter*? *Facit* 1,l. 12,s. 10,d.

18 If 6, *bu.* 1¼*pe.* 3, *pin.* coſt 1,l. 6,s. 8,d. what will a *quarter* coſt? *Facit* 1,l. 13,s. 6,d. 2,f.

19 *Example*, 1, *bu.* coſts 2,s. 9,d. 1,f. what is that the *quarter*? *Facit* 1,l. 2,s. 2,d.

20 If 1, *peck* coſts 1,s. 1,d. 2,f. what will a *quarter* coſt? *Facit* 1,l. 16,s.

21 If the *pint* coſts 1,d. 2,f. what coſts the *quarter*? *Facit* 3,l. 4,s.

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6 By long meaſures.

22 If 205¾ *yeards* or *ells*, and 2, *nai.* coſt 33,l. 0,s. 6,d. 2,f. what is the price of a *yeard* or *ell*? *Facit* 3,s. 2,d. 2,f.

13 If

23 If $\frac{1}{2}$ *yeard* $3\frac{1}{4}$ *nai.* of Scarlet coſt 45,s. 6,d. what will a *yeard* of the ſame Scarlet coſt? *Facit* 3,l. 4,s. 8,d. $2\frac{3}{10}$f.

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7 By time.

24 A ſcholler paid for his diet in 5 *yeares* 3, *moneths* and 17 *dayes* 35,l. 6,s. 2,d. 2,f. How much was that *per annum*? *Facit* 6,l. 13,s. 4,d.

25 A Common Souldier receives for the pay of 7 *moneths* and 21 *dayes* the ſum of 7,l. 14,s. How much is his pay for the whole *yeare*? *Facit* 12,l. 0,s. 4,d.

26 If the expences of a *moneth* conſiſting of 28 *dayes* amount to 6,l. 13,s. 4,d. what will the expences of an whole *yeare* amount unto *Facit* 86,l. 18,s. 1,d.

27 If one ſpend 3.l. 6,s. 8,d. in a *weeke* or 7 *dayes*, what will his expences be in the *yeare*? *Facit* 173,l. 16,s. 3,d.

28 One ſpends 3,s. 4,d. the *day*, what will that amount unto in the *yeare*? *Facit* 60,l. 16,s. 8,d.

8 By the dozen.

29 If 5 *groſſe*, 7, *doz.* and 5 *perticulars* coſt 37,l. 9,s. 1,d. what will a *groſſe* coſt? *Facit* 6,l. 12,s. 4,d.

30 If 10, *doz.* and 7 coſt 2,l. 7,s. 5,d. what is the price of a *groſſe*? *facit* 2,l. 13,s. 9,d. $0\frac{8}{10}$f.

If

31 If a *dozen* coſts 2,s. 7,d. 2,f. what is that the *groſſe*? *Facit* 1,l. 11,s. 6,d.

32 A *paire* of Gloves coſts 1,s. 3,d. 1,f. what is that the *groſſe*? *Facit* 9,l. 3.s.

Queſtions of Coine.

33 A Goldſmith gives 251, l. 6,s. 8,d. *ſterling* for 237 *Ryders*, what is that a piece? *Facit* 1,l. 1,s. 2,d. 2,f. *ſterling*.

34 A Gentleman gives a Merchant 199,l. 1,s. 3,d. *ſterl.* for 650 *French* crowns, what is that the crown? *Facit* 6,s. 1,d. 2,f. *ſterling*.

V. *The value of any thing being divided by the rate of the Integer, that meaſures it, gives you in the Quotient the quantity of the ſame thing.*

1 *Example*, How much white Plate will 10,l 10,s 4,d. 3,f. buy at the rate of 3,l. 6,s. 8,d. the *lb*? *Facit* 3,*lb*. 1,*ounc*. 17.*p*. 10,*gr*.

10,l.10,s.4,d.3,f.	10.519	1.02198
3,l.6,s.8,d.	3.3333	0.52287
3,*lb.*1,*ou.*17,p.10,*gr.*	3.1559	0.49911
	.08333	
	07257	
	07083	
	c0174	

2 How many *Escus d' or* ought I to receive at *Paris* for 71,l. 16,s. 6,d. *sterl.* delivered in London, every *Escus d' or* being valued at 38,l. or(which is all one) at 7,s. 7,d. o $\frac{833}{1041}$ f. *sterling*? *Facit* 189 *Escus d' or.*

3 When the *Exchange* from Hambrough to London is at 1,l. 5,s. 9,d. *Flemish* for 1,l. *sterling*. How much may I have at London in *sterling* money for 133,l 2,s. *Flemish* delivered in Hambrough ? *Facit* 103,l 7,s. 8,d. *sterl.*

4 Hovv many *Florins* ought I to receive for 70,l. 15,s. 6,d. *sterling*, each *Florin* being estimated at 3,s. 2,d. *sterling*. *Facit* 447, *Florins.*

70,l.

70,l.15,s.6,d.*st.*	70.775	1.84992
3,s.2,d.	.15833	—0.80041
447.*Florins*	447.	2.65033

And now *observe*, that in all the precedent examples produced either here, or under the 7 rule of the last chapter, which serve for the *Reduction* of one coine into another, this is the generall rule; *When you are to reduce a greater Coine into a lesse, Add*; *contrariwise for the Reduction of a lesser Coine into a greater, Subtract the Logarithmes of the termes propounded.* So in the last example, the *Proposition* being made of converting pounds *sterling* into *Florins* (*viz.* of a greater into a lesse) you are to adde together the Logarithmes of the *termes* propounded: On the other side, in the last example of the 7 rule of the last chap. the *Question* being put of reducing *Florins* into pounds *sterling* (*viz.* the lesse into the greater) in that case you must deduct the Logarithmes of the given *termes*, the one out of the other; as may *plainly* appeare by the severall *operations* of those premised Examples.

A generall rule for the Reduction of one coine into another.

And this doubtleſſe is the beſt and readieſt way to convert one coine into another, when the *operation* is ruled by the knowne *rate* of a ſingle piece of either of the Coines in Queſtion: But otherwiſe for their *reduction* you are to uſe the *Rule of three*, as ſhall be further declared hereafter.

Laſtly, take notice, that here we might likewiſe produce other rules of *Diviſion*, which might anſwer as *Inverſes* to the 8, and 9, rules of the laſt chapter; but becauſe the *operations* which might be derived from thence would rather ſerve for curioſity then uſe, we will for the preſent let them paſſe, not doubting but that the induſtrious *Reader* will by this time be able to frame thoſe and the like *rules* himſelfe, as alſo to work divers other examples of *Multiplication*, and *Diviſion* which here for brevitie ſake we have omitted.

Chap. 9.

The Extraction of the Square-Root.

TO finde the Square-root of any number given, take half the Logarithme of the ſame Number, this done, that halfe is the Logarithme of the Root required, which is alwayes of the ſame kinde with the Logarithme of the number given: And therefore here the *Extraction* of the Square-root is performed by *Bypartition.*

The uſe of Logarithms in the extraction of the Square-root. Peruſe the 13 rule of the 2 chap of this book. See this example in the 6 chapter of the 1 book.

1 *Example*, 43623 being given to be *Exracted*, his Square-root is 208.86, for the Logarithme of 43623 (by the 1 rule of the 6 chapter of this preſent book) is 4.63972, whoſe *halfe* (by the 20, rule of the 5 chapter of the 1 book) is 2.31986, vvhich (by the 9 rule of the 6 chapter of this book) is the Logarithme of 208.86, the *root* required.

The ſquare	43623	4.63972
The root	208.86	2.31986

2 *Example*, 172.68 being given, his *root* is 13.141

The ſquare	172.68	2.23724
The root	13.141	1.11862

3 *Example*, $\frac{3}{4}$ being given, his *root* is .866

The ſquare	$\frac{3}{4}$	—0.12494
The root	.866	—0.06247
Complement		93753

Chap. 10.

The Extraction of the Cube-root.

The uſe of Logarith. in the extraction of the Cube. Root, Peruſe againe the 13 rule of the 2 chapter of this book.

For the Extraction of the Cube-root, tripartite the Logarithme of the number given, this done, that third part is the Logarithme of the root required, which is alwayes of the ſame kinde with the Logarithme of the number propounded. And therefore here the *Extraction* of the Cube-root is performed by *Tripartition.*

1 *Example*,

1 *Example*, the number 8302348 being given, his *Cube root* is 202.48. See this example in the 7 chapter of the 1 Book.

The Cube	8302348	6.91920
The Root	202.48	2.30640

2 *Example*, 172.68 being propounded, his *root* is 5.568.

The Cube	172.68	2.23724
The Root	5.568	0.74575

3 *Example*, $\frac{3}{4}$ being given, his *Root* is .9085

The Cube	$\frac{3}{4}$	—0.12494
The Root	.9085	—0.04165
Complement		95835

Chap. 11.

Betwixt two numbers given, to finde a meane proportionall.

1. THus far the use of the Logarithmes in Single Arithmetique, here followes also their use in the operations of Comparative Arith-

Arithmetique, which chiefely consists in the easie resolution of the Propositions following.

Here perus the 21 & 25 rules of the 9 chapter of the 1 book.

1 *Betwixt two numbers given, to finde a mean Proportionall.*

2 *Betwixt two numbers given, to finde two mean Proportionals.*

3 *Having three numbers given, to finde a fourth in a duplicated Proportion.*

4 *Having three numbers given to finde a fourth in a triplicated Proportion.*

To work
5 *The rule of three direct.*
6 *The rule of three inverse.*
7 *The double golden rule direct.*
8 *The double golden rule inverse*
9 *The rules of plurall proportion*
10 *The rule of Fellowship.*
11 *The rule of Allegation.*

To finde a mean proportionall. 1 When the Logarith. of the numbers given are both of the same kind.

II. *To finde a mean Proportionall betwixt two numbers given, proceed in this manner; When the Logarithmes of the numbers propounded are both of the same kinde, add them together, then halfing that sum, you have the Logarithme of the mean proportionall required*

quired, which Logaritme ſo found is in this caſe of the ſame kinde with the Logarithmes of the numbers given.

1 *Example*, 12, and 172.68 being given, the *mean Proportionall* betwixt them will be found 45.52; for as 12 to 45.52, ſo the ſame 45.52 to 172.68.

The numbers given	12.	1.07919
	172.68	2.23724
The ſum of the Logarithmes		3.31643
The mean prop. required	45.52	1.65821

2 *Example*, .05, and $\frac{3}{4}$ being given, the *mean proportionall* required is. 19365.

The numbers given	.05	—— 1.30103
	$\frac{3}{4}$	—— 0.12494
The ſum of the logarithmes		1.42597
The mean prop. required	.19365	-0.71298
The Complement.		28702

III. *When*

2 When they are of divers kinds.

III. *When the Logarithmes of the numbers given are of divers kinds, ſubtract the leſſer out of the greater, this done, halfe that difference is the mean Logar. of the Proporcionall demanded, which is in this caſe alwayes of the ſame kinde with the greater Logarithme of the numbers given.*

1 *Example*, $\frac{3}{4}$ and 12 being given, the *meane proportionall* required is 3.

The numbers given	$\frac{3}{4}$	—0.12494
	12.	1.07919
The difference of the Lo.		0.95425
The mean prop. required.	3.	0.47712

2 *Example*, .05, and 12 being propounded, the *mean proportionall* required is .7746.

The numbers given	.05	—1.30103
	12.	1.07919
The difference of the Log.		0.22184
The mean prop. required	.7746	—0.11092
The Complement		88908

Chap. 12.

Betwixt two numbers given to finde two mean proportionalls.

To finde two mean Proportionals.

1 When the Logarithmes of the numbers given are both perfect.

I. *When the Logarithmes of the numbers given are both perfect, ſubtract the leſſer out of the greater, to the end you may know the difference betwixt them, this done, if you add the third part of that difference unto the Logarithme of the leaſt number propounded, you have the Logarithme of the leſſer meane Proportionall demanded, to which Logarithme if you again add the ſame third part, you ſhall have the Logarith. of the other mean proportional required: And here the Logarithmes of the mean proportionals ſo found are alwayes of the ſame kinde with the Logarithmes of the numbers given.*

Example, 12, and 172.68 being given, the two *mean proportionals* betwixt them are 29.188, and 70.99; for as 12 to 29.188, So is 29.188 to 70.99, and ſo likewiſe 70.99 to 172.68.

The

The numb. given	12.	1.07919
	172.68	2.23724
The differ. of the Logarithmes		1.15805
The third part thereof		38602
The leſſer mean prop.	29.188	1.46321
The greater mean prop.	70.99	1.85123

3 When they are both defective.

II. *When the Logarithmes of the numbers given are both defective, finde the difference betwixt them, as before; this done, if you add the third part of that difference unto the Logarithme of the greateſt number propounded, you ſhall have the Logarithm of the greater mean Proportionall demanded, to which Logarithme if you again add the ſame third part, you have the Logarithme of the other mean Proportionall required: And in this caſe the Logarithmes ſo found are likewiſe of the ſame kinde with the Logarithmes of the numbers given.*

Example, $\frac{3}{4}$ and .05 being given, the *mean Proportionals* betwixt them are .30411 and .12359, for as $\frac{3}{4}$ is to .30411, ſo is .30411 to .12359, and ſo .12359 to .05.

The

The numbers given	$\frac{3}{4}$	—0.12494
	.05	—1.30103
The difference of the Log.		1.17609
The third part thereof		39203
The greater mean prop.	.30411	—0.51696
The Complement		48304
The lesser mean prop.	.12359	—0.90899
The Complement		09200

III. *When the Logarithmes of the numbers given are of divers kinds, add them together & take the third part of the sum; this done, if you may, subtract the Logarithm of the broken number given out of that third part, the remainder being the Logarithme of the lesser mean Proportionall required, is alwayes in this case perfect, unto which if you add the same third part, that sum is the Logarithm of the other mean Proportionall demanded, which likewise must needs be a perfect Logarithme.*

3 When they being of divers kinds, the Logarithm of the fraction may be subtracted out of the third part of the sum.

Example, $\frac{3}{4}$ and 12 being given, the two *mean Proportionals* betwixt them are 1.8899 and 4.7622; for as $\frac{3}{4}$ to 1.8899, So 1.8899 to 4.7622. and so 4.7622 to 12.

The

The numbers given	$\frac{3}{4}$	0.12494
	12.	1.07919
The ſum of the Logarithmes		1.20413
The third part thereof		0.40137
The leſſer mean prop.	1.8899	0.27643
The greater mean prop.	4.7622	0.67780

4 When they being of divers kindes, the third part of the ſum may be ſubtracted out of the Logarithme of the fraction.

IV. *When the Logarithmes of the numbers given are of divers kinds add them together, and take the third part of their ſum, as before; then if you may ſubtract that third part out of the Logarithme of the broken number given, the remainder being the Logarithme of the leſſer proportionall required, is alwaies in this caſe defective, out of which Logarithme if you may yet ſubtract the ſame third part, the laſt remainder is the Logarithme of the other mean Proportionall demanded, which likewiſe in this caſe is a defective Logarithme, as before: But if in finding the laſt proportionall you may ſubtract the Logarithme of the firſt proportionall found out of the third part, the remainder is the Logarithme of the laſt proportionall required, which in this caſe is alwaies a perfect Logarithme.*

1 *Example*, .0033333, and 11.25 being given, the two *mean Proportionals* between them are .05, and .75, or $\frac{3}{4}$ for as .0033333 to .05, so 05 to .75, and so .75 to 11.25.

The numb. given	.0033333	2.47712
	11.25	1.05116
The sum of the logarithmes		3.52829
The third part thereof		1.17609
The lesser mean prop.	.05	—1.30103
The Complement		69897
The other mean prop.	.75	—0.12494
The Complement		87506

2 *Example*, .05 and 12 being given, the two *mean proportionals* betwixt them are .31072, and 1.931.

The numbers given	.05	—1.30103
	12.	1.07919
The sum of the Logarithmes		2.38022
The third part thereof		0 79340
The lesser mean prop.	.31072	—0.50763
The Complement.		49237
The other mean prop.	1.931	0.28577

CHAP.

Chap. 13.

Having three numbers given to finde a fourth in a duplicated Proportion.

I. *Double the difference of the Logarithms which belong to the two termes, that have the same Denomination; then (if the first term be lesse then the second) Add that difference doubled to the Logar. of the other terme, this done, the sum is the Logarithme of the fourth terme required*

Example, The *superficiall Content* of a *Circle*, whose *Diameter* is 14 *Inches* being 154 *Square Inches*, what is the *Content* of another *Circle*, whose *Diameter* is $25\frac{3}{4}$ *Inches? Facit* 521 *Square Inches.*

Diameter	14.	1.14612
Diameter	25.75	1.41078
Difference		0.26466
Difference doubled		0.52932
Content given	154.	2.18752
Content required	521.	2.71684

II. *But*

II. *But if the first term be greater then the second, subtract the difference doubled, from the Logarithme of the other term.*

Example, the *content* of a *Circle*, whose *Diameter* is 25 ¾ *Inches*, being 521 *square Inches*, what is the *Content* of another *Circle* whose *Diameter* is 14 *Inches*? *Facit* 154 *square Inches*.

Diameter	25.75	1.41078
Diameter	14.	1.14612
Difference		0.26466
Difference doubled		0.52932
Content given	521.	2.71684
Content required	154.	2.18752

CHAP. 14.

Having three numbers given, to find a fourth in a Triplicated Proportion.

I *TRiple the Difference of the Logarithmes which belong to the two terms, that have the same Denomination, then (if the first term be lesse then the second) Adde that difference so tripled to the Logarithme of the other terme,*

and so shall you have the Logarithme of the forth terme demanded.

Example, If a *Bullet*, whose *Diameter* is 4, *Inches*, weigh 9, ℔. *Averdu pois little waight*, How much will another *Bullet* weigh, whose *Diameter* is $6\frac{1}{4}$ *Inches*? *Facit* 34, ℔. 5 *ounc.* $6\frac{1}{4}$ *drams*, and somewhat more.

Diameter	4.	0.60206
Diameter	6.25	0.79590
Difference		0.19384
Difference tripled		0.58152
Waight given	9.	0.95424
Waight required	34.337	1.53576
	3125	
	0245	
	0234	
	11	

II. *But if the first terme be greater then the second, subtract the difference tripled, from the Logarithme of the other terme.*

Example, If a *Bullet* whose *Diameter* is $6\frac{1}{2}$ *Inches*, weigh 34, ℔. 5, *ounc.* $6\frac{1}{4}$ *drams*: what will another *Bullet* weigh whose *Diameter* is 4 *Inches*? *Facit* 9, ℔.

Diameter

Diameter	6.25	0.79590
Diameter	4.	0.60206
Difference		0,19384
Differencetripled		0.58152
Waight given	34.3369	1.53576
Waight required	9.	0.95424

Here obſerve that the *propoſitions* of theſe two laſt *Chapters* will admit of other rules, as well as thoſe of the ſix precedent *Chapters*, according to the *nature* of the *termes propounded*, and of the *Logarithmes* by which the *worke* is performed; but this (for brevity ſake) amongſt many other things, I leave to the *curioſity* of the *ingenious Reader*.

Chap. 15.

The Rule of three direct.

For as much as all the ſeverall kindes of the *Golden Rule* are performed by *Multiplication*, and *Diviſion*, the Inſtructions before delivered in the 21, 22, 23, 24, 25, 26, and 27 *chapters* of the 1 *book* being

carefully obſerved, together with thoſe of the *ſeventh* and *eighth chapters* of this preſent *booke*, may ſuffice to inſtruct the Induſtrious *Reader* how to *facilitate* the ſeverall operations of that Rule alſo by the helpe of the Logarithmes: Nevertheleſſe for plainneſs ſake we wil here annex ſome few examples by which their excellent uſe in the working of the ſeverall kindes of that Rule likewiſe may be the better illuſtrated: And here in the firſt place we intend to preſent unto you examples of the Rule of three direct.

See this example in the 9 rule of the 10 chapter of the 1 book.

1 If 457 Souldiers take a Booty worth 1237,l. I demand how much of it ſhall belong to a *Company* of them compoſed of 83 perſons: Here the three termes propounded are 457, 1237, and 83, And now becauſe in *naturall Arithmetique* the fourth terme is diſcovered by dividing the product of the two *mean* terms by the *firſt* term (according to the 9 rule of 21 chapter of the firſt book) in ſtead of multiplying the ſaid *mean* termes, taking their Logarithmes, *viz.* 3.09236, the Logarithm of 1237, and 1.91907, the Logarithme of 83, I add them together into one ſum, *viz.* 5.01143, which by the

4 rule

4 rule of the 7 chapter of this book is the Logarithme of their *product*: again, because the product of those two *mean* termes ought to be divided by 457, the *first* terme, I deduct 2.65991 the Logarithme of the same 457, out of 5.01143, the Logarithme of the *product*: this done, the *remainder* is 2.35152 which by the 2 rule of the 8 chapter of this book is the Logarithme of 224.66 the *Quotient*, or fourth terme required: So that at last I conclude the *proportionall* part of the Booty due to the 83 Souldiers is 224 *pounds* and $\frac{66}{00}$ of a *pound*, which decimal being reduced to *shillings*, and *pence* (by the 18 rule of the 12 chap. of the 1 book) is 13,s. 3,d. And therefore the whole sum due unto them, as aforesaid, being reduced to *English* money is 224,l, 13.s. 3,d.

457.	457.	2.65993
1237.	1237.	3.09236
83.	83.	1.91909
		5.01145
224,l.13,s.3,d.	224.66	2.35153

This Rule may be also often performed

by Addition onely, the 3 and 4 rules of the 8 chapter aforegoing being duly obſerved. For (in this *example*) if inſtead of the Logarithme of the firſt terme, you take the whole Arithmeticall Complement thereof, and then adding it to the Logarithmes of the other two given termes, cut off from the totall the firſt figure towards the left hand, the figures remaining towards the right hand are the Logarithme of the fourth terme requied: See the worke,

457.	7.34007
1237.	3.09236
83.	1.91909
224.66	1.2.35152

2 If a Cheſt of Sugar, that weighs 7.*C* 2, *qu.* and 17, *lb.* coſts 37,l.14,s.10,d. what is the *price* of 2,*C*. 1,*qu.* and 4, *lb.* of the ſame Sugar according to the ſame *rate? Facit* 11,l. 5,s. 6,d.

$7\frac{1}{2}$*C*.17, *lb.*	7.65178	0.88375
37,l.14,s.10,d.	37.741666	1.57683
$2\frac{1}{4}$*C*. 4 *lb.*	2.285714	0.35904
		1.93587
11,l. 5,s.6,d.	11.275	1.05212

3 A. being *indebted* unto B. in the ſum of 11,l. 5,s.6,d. buyes a Cheſt of Sugar, that weighs $7\frac{1}{3}$C. 17,*lb*. for 37, l. 14,s. 10,d. B. is willing to take for his *debt* ſo much of this Sugar as may be in *value* worth 11,l. 5,s.6,d. according to the rate that A. paid for it: Now the *queſtion* is how much of this Sugar A. ought to deliver to B. to the end his *debt* may be ſatisfied? *Facit* $2\frac{1}{4}$,C. 4,*lb*.

37,l. 14,s. 10,d.	37.741666	1.57683
$7\frac{1}{3}$C. 17. *lb*.	7.65178	0.88375
11,l. 5,s.6,d.	11.275	1.05212
		1.93587
$2\frac{1}{4}$C. 4,*lb*.	2.2857	0.35904
	25	
	0357	

4 When $\frac{3}{4}$ of a Ship amount to 119,l. 17,s. 3,d. what are $\frac{7}{8}$ of the ſame Ship worth? *Facit* 174,l.16,s. *Ferè*.

	$\frac{3}{4}$	——0.22185
119,l. 17,s. 3,d.	119.8625	2.07868
$\frac{7}{8}$	$\frac{7}{8}$	——0.05800
		2.02068
174,l.16,s.	174.8	2.24253

In

In this *Example* obſerve that 2.07868 and —— 0.05800 the Logarithmes of the *mean* termes ought to be deducted, the one out of the other, becauſe they are Logarithmes of *divers* kindes according to the 5 rule of the 7 chap. of this book: Again ——0.22185 the Logarithme of the firſt terme or *Diviſor*, and 2.02068 the Logarithme of the product or *Dividend* are to be added together, becauſe likevviſe they are Logarithmes of *divers* kindes, according to the 5 rule of the 8 chapter of this book. Laſtly, 2.24253 the Logarithm of the term required muſt of neceſſity be a *perfect* Logarithme, becauſe 2.02068 being a *perfect* Logarith. ſheweth the number unto vvhich it belongs (and vvhich in this example is the *Dividend*, as aforeſaid) to be greater then the *Diviſor*, according to the 1 rule of the 8 chapter of this booke. Theſe obſervations and the like muſt be carefully made in all the ſubſequent examples of this and the other kindes of the *Golden Rule*, for otherwiſe the terme required can never be rightly diſcovered.

By theſe premiſed examples you may eaſily perceive, that the rules of *Multiplication*, and *Diviſion* by the Logarithmes being

being duly obſerved, this *Rule of three*, as alſo all the other kindes of the *Golden rule*, and the *Rule of Falſe*, may be readily performed by *Addition* and *Subtraction* & oftentimes by Addition onely: So that it vvill be only neceſſary hereafter briefly to propound and reſolve certain familiar examples of this, & the other *rules* above mentioned, without ſending you back again upon every occaſion, to thoſe *inſtructions* before produced in the 7 and 8 chapters of this preſent book, which being vvell ſtudied, will afford you a pattern of *Multiplication* and *Diviſion* for any example, that may be propounded.

Queſtions of practiſe, which concern things meaſured 1 By Troy waight.

If an *ounc.* of gold be vvorth 3,l.8,s.7,d. what are 2, *lb.* 4 *ounc.* 6. *p.* 15 *gr.* of the ſame Gold vvorth? *Facit* 97,l. 3,s.

1.	*ounce*	.083333	—1.07918
3. 8. 7.		3.42916	0.53529
2. 4. 6.15.		2.3609	0.37307
			0.90827
97. 3. s.		97.15	1.98745

6 What

6 What are 2,*lb*. 4, *ounc*. 6,*p*. 15,*gr*. of Gold *worth* at 3,s. 4,d. the *peny weight*? *Facit* 94,l. 8,s. 8,d.

		1,*p*.	.0041666	−2.38024
	3.	4.	.16666	−0.77819
2.	4.	6. 15.	2.3609	0.37307
				−0.40512
94.	8.	8.	94.43	1.97512

Se the exposition of the 2 rule of the 6 chapter of this book.

In this *Example*, 1.97512 the Logarithme of the terme required muſt needs be a *perfect* Logarithme, becauſe −0.40512 the Logarith. of the *Dividend* ſheweth the fraction unto which it belongs, to be greater then .0041666 the *Diviſor*, whoſe Logarith. is 2.38024; for the greater a *Defective* Logarithme is, the leſſe is the fraction, unto which it appertaines, *& contrà*.

7 What are 2,*lb*. 4,*ounc*. 6,*p*. 15,*gr*. of gold *worth* at $1\frac{2}{3}$d. the *grain*? *Facit* 94,l. 8,s. 8,d.

1,*gr*.

1, *gr.*	.00017361	—3.76041
$1\frac{2}{3}$d.	.0069442	—2.15837
2.4.6. 15.	2.3609	0.37307
		—1.78530
94.8.8.	94.43	1.97511

8 If 10, *lb.* 7, *ounc.* 9, *p.* 11, *gr.* of gold cost 427, l. 9, s. 10, d. what is that the *ounc?* *Facit* 3, l. 7, s. 0, d. $3\frac{4}{10}$f.

9 What is that the *penny waight?* *Facit* 3, s. 4, d. 1, f.

10 What is *a grain* of the same gold worth? *Facit* 1, d. $2\frac{738}{114}$f.

11 What are 9, *ounc.* 13, *p.* 8, *gr.* of gold worth at 3, l. 11, s. 8, d. the *ounce?* *Facit* 34, l. 12, s. 9, d. 2, f.

12 What is the *value* of so much gold at 3, s. 7, d the *penny waight?* *Facit* 34, l. 12, s. 9, d. 2, f.

13 How much are 9, *ounc.* 13, *p.* 8, *gr.* of gold worth at 1, d. 3, f. the *grain?* *Facit* 33, l. 16, s. 8, d.

14 A Gold-smith buyes 9, *cunc.* 13, *p.* 8, *gr*, of gold, for 34, l. 12, s. 9, d. 2, f. what is that the *ounce?* *Facit* 3, l. 11, s. 8, d.

15 What is that the *penny waight?* *Facit* 3, s. 7, d.

16 What

16 What is a *grain* of the same gold worth? *Facit* 1,d.3 $\frac{174}{1641}$f.

17 If an *ounce* of gold be worth 3,l.11, s.8.d. what is a *penny waight* of the same gold worth? *Facit* 2,s.7,d.

18 What is a *grain* of that gold worth? *Facit* 1,d.3 $\frac{174}{1641}$ f.

19 When a *grain* of gold is worth $1\frac{2}{3}$d. what is a *penny waight* of the same gold worth? *Facit* 3,s.4,d.

20 What is an *ounce* of that gold worth? *Facit* 3,l.6,s.8,d.

21 If a *penny waight* of gold be worth 3,s.4,d. what is an *ounce* of that same gold worth? *Facit* 3,l.6,s.8,d.

22 What is a *grain* of that gold worth? *Facit* 1,d. 2 $\frac{695}{1641}$ f. which is equivalent to $1\frac{2}{3}$ d.

What a caret fine is, *Vide l.1.cha. 27.rule 10.*

23 If gold of 22 *Carects* fine be worth 3,s.4,d. the *penny waight*, what is the value of a *penny waight* of gold which is 19 $\frac{1}{4}$ *Carects* fine? *Facit* 2,s.11,d.

22 *Car.*	22.	1.34244
3,s.4,d.	.16666	—0.77819
$19\frac{1}{4}$ *Car.*	19.25	1.28447
		0.50628
2,s.11,d.	.14538	—0.83616
		16384

24 What

24 What is the *price* of divers pieces of *white* plate, which having equall *fineneſſe*, weigh altogether 68 *ounces* 5, *p.* 17, *gr.* or (which is all one) 5, *lb* 8, *ounces* 5, *p.* 17, *gr.* at 5, s. 8, d. 3. f. the *ounce*? *Facit* 19, l. 11, s. 3, d.

25 What is the value of 16, *lb*. 3, *ounces* 13, *p.* 8. *gr.* of *gilt* plate at 5, d. 1, f. the *penny waight*? *Facit* 85, l. 12, s, 3, d.

26 A Goldſmith buyes 3755, *lb*. 5, *ounces* 9, *p.* of ſilver *Bullion* for 10514, l what doth every *ounce* of that *Bullion* ſtand him in? *Facit* 4, s. 8, d.

27 What doth every *penny waight* of that *Bullion* coſt the Goldſmith? *Facit* 2, d. 3 $\frac{207}{1041}$ f.

28 What is the price of a piece of *gilt* plate, that weighs 11, *ounces*, 3, *p.* 19, *gr.* at 8. s. 7, d. 1, f. the *ounce*? *Facit* 4, l. 16, s, 3, d.

29 What is the value of a piece of *white* plate, that weighs 11, *ounces* 3, *p.* 19, *gr.* at 3 $\frac{1}{3}$ d. the *penny waight*? *Facit* 3, l. 2, s, 2, d.

In this *example* you are to add .0013888 (being the third part of .0041666, the *decimall* of 1, d.) to .0125 the *decimall* of 3, d. to the end you may have .0138888, *viz.* the correſpondent *decimall* of 3 $\frac{1}{3}$ d. the ſecond term of the *queſtion* propounded.

30 A man buyes 11,*ounc.* 2 *p.* 19,*gr* of *white* Plate for 3,l 2,s 2,d. what is that the *ounce*? *Facit* 5,s. 6.d. $2\frac{8}{10}$f.

31 What doth every *penny weight* of the ſame plate ſtand him in? *Facit* 3,d. 1 $\frac{347}{1041}$ f. which is equivalent to $3\frac{1}{3}$ d.

32 If an *ounce* of ſilver be worth 5,s. 5,d. what is a *penny waight* of the ſame ſilver worth? *Facit* 3,d. 1,f.

33 If a *penny waight* of ſilver be worth 3,d. 1,f. what is an *ounce* of the ſame ſilver worth? *Facit* 5,s. 5,d.

The fineneſs of ſilver diſtinguſhed by the ounc.

34 What is ſilver of 9, *ounc.* 11,*p.* 14.*gr. fine*, worth the *ounc.* when other ſilver, that is 11 *ounc.* 2,*p. fine* is *valued* at 5,s. 3,d. the *ounce*? Before you can well underſtand how to anſwer this *Demand* you muſt obſerve; that as the *fineneſſe* of *Gold* is meaſured by *Carects*, ſo is the *fineneſſe* of *Silver* eſtimated by *ounces:* In ſuch ſort, that a *pound* of *Silver*, which being *tryed* a certain time in the fire loſeth nothing of the *waight*, is ſaid to be 12 *ounces fine.* But a *pound*, that being *tryed* loſeth ſomewhat of the *waight*, is ſaid to be the *remainder* of the *waight fine. Example*, A *pound* of *Silver* that loſeth in the fire 1 *ounc.* 8,*p.* is eſtimated to be 10,

ounc.

ounc. 12, *p. fine*, and that, which loseth 2, *ounc.* 8. *p.* 10, *gr.* is said to be 9, *ounc.* 11, *p.* 14. *gr. fine*, &c. This being premised if you proceed to the resolution of the *question* you shall finde the *Facit* to be 4, *s.* 6, *d.* 1 $\frac{42}{164}$ *f.*

11. 2.	.925	——0.03384
5. 3.	.2625	——0.58087
9, 11. 14.	.79826	——0.09784
		——0.67871
4. 6. 1 $\frac{42}{164}$	.22653	——0.64487
		3513

35 What is the *price* of 7 $\frac{1}{2}$ *C.* 19 $\frac{1}{2}$ *lb.* at 27, *s.* 5, *d.* the *Tod* or quarter, consisting of 28, *lb. Averdupois? Facit* 42, *l.* 1, *s.* 4, *d.* By Averdupois Great waight.

28, *lb.*	.25	——0.60209
1, *l.* 7, *s.* 5, *d.*	1.3708	0.13697
7, *C.* 2, *qu.* 19, *lb.* 4, *ou.*	7.6718	0.88489
		1.02186
42, *l.* 1, *s.* 4, *d.*	42.066.	1.62392

36 What

36 What is the *value* of 5,*C*.3.*qu*.17,*lb*. of Flax at 16,s. 4,d. the *Stone* when the *Stone* consists of 14 *lb* ? *Facit* 38,l.11,s. 2,d.

37 What do 0,*C*.3,*qu*.4, *lb*. come to at 1,s.6,d.,f. the *Stone*, accounting eight pound to the *Stone* ? *Facit* 16,s.10,d. *Ferè*.

38 What do 12,*C*.2,*qu*.0 $\frac{1}{4}$ *lb* amount unto at 4,d.2,f. the *lb* ? *Facit* 28,l.10,s, 5,d.2,f.

1,*lb*.		.0089285	—2.04922
4.	2.	.01875	—1.72700
13.	2. 9. 4.	13.5825	1.13296
			—0.59404
28.	10. 5. 2.	28.522	1.45518

39 What do 13,*C*.2,*qu* 9 $\frac{1}{4}$ *lb*. amount unto at 4,d.2,f. the *ounce* ? *Facit* 456,l.6,s. 10,d.

1,*ounce*		.00055804	—3.25333
4.	2.	.01875	—1.72700
13.2.	9. 4.	13.5825	1.13296
			—0.59404
456.6.	10.	456.34	2,65929

40 How much do 0 ¼ *C.* 25, *lb.* 7 ¼ *ounce* come to at 9, d. 2, f. the *lb*? *Facit* 4, l. 6, s. 8, d. *fere.*

.0089285	——2.04922
.03958	——1.40252
.9772	——0.01000
	——1.41252
4.332	0.63670

41 How much do the same 0, *C.* 3, *qu.* 25, *lb.* 7 ¼ *ounce* amount unto at 9, d. 2, f. the *ounce*? *Facit* 69, l. 6, s. 3, d.

42 A Grocer buyes 24, *Tun.* 11, *C.* 14, ¾ *lb.* of Tobacco for 10802, l. unto how much doth a *Quarter* or 28, *lb.* thereof amount after the same *rate*? Here because a *Tun waight* consists of 20, *C.* (according to the 31, rule of the 1 Chap. of the 1 Book) you are first to dissolve the 24 *Tun* into *Hundreds, viz.* by multiplying the same 24, by 20; for the product thereof *viz.* 480, is the number of *Hundreds* conteined in the 24 *Tun* propounded, unto which if you yet add the 11 odde *Hundreds*, their Totall is 491, *C.* In such sort that now the *Question* ought thus to be stated. A Grocer buyes 491, *C.* 14 ¼ *lb.* of Tobacco for 10802, l. what is that the *Quarter*? *Facit* 5, l. 9, s. 11, d. 3, f. *fere.*

43 What is that the ℔. *Facit* 3,s. 11,d. 0. $\frac{54}{104}$f.

44 What is that the *Ounce* ? *Facit* 2,d. 3 $\frac{815}{1041}$ f.

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3 By Averdupois little waight.

45 What is the price of 89, ℔. 3, *Ounces* of *Cloves* at 4,d. 3,f. the *Ounce* ? *Facit* 28,l. 5,s. 3,d.

1, *Ounce*	.0625	—1.20410
4,d. 3,f.	.019791	—1.70352
89, ℔. 3, *Ounces*	89.25	1.95060
		0.24708
28,l. 5,s. 5,d.	28.262	1.45118

46 What do 7, *Ounces* 11 $\frac{3}{4}$ *drams* of *Musk* amount unto at 2 d. 3,f. the *dram* ? *Facit* 1,l. 8 s. 4,d. 2,f.

47 A Silkman buyes 57, ℔. 15, *ounces* 5, *drams* of *Silk* for 94, l. 9, s. 8,d. What is that the *Ounce* ? *Facit* 2, s. 0. d. 1 $\frac{85}{104}$ f.

48 One buyes 17, ℔. 13 $\frac{1}{4}$ *Ounces* of *Ambergreese* for 1428, l 6,s. 2,d. what is that the *dram* ? *Facit* 6,s. 3,d 0 $\frac{43}{104}$ f.

49 A parcell of *Musk* is bought at the *rate* of 3,s. 8,d the *Ounce*, what is that the *dram* ? *Facit* 2,d. 3,f.

50 A

50 A parcell of *Muske* is bought after the *rate* of 2,d. 3,f. the *dram*, what is that the *ounce*? *Facit* 3,s. 8,d.

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51 What is a *Tun* of wine worth at 6,d. $0\frac{1}{2}$ f. the *Pint*? Here reduce 6, d. $0\frac{1}{2}$ f. to .0255208, *viz.* by adding .0005208 (halfe the *Decimall* of 1,f.) to .025 (the *Decimal* of 6,d.) and then proceeding as in the former operations, you shall finde the *Facit* to be 51,l. 8,s. 10,d. 4 By liquid measures. *Vide l. 2. ch. 7 r, 7. example. 31.*

1, *Pint*	.125	——	0.90309
6,d. $0\frac{1}{2}$ f.	.0255208	—	1.59311
1, *Tun.*	252.		2.40140
			0.80829
51,l. 8,s. 10,d.	51.44		1.71138

52 What is a *Tun* of wine worth at 1,s. 0,d. 1,f. the *Quart* or two *Pints*? *Facit* 51,l. 8,s. 10,d. *Ibidem example 32.*

53 A *pipe* of Oile conteining 122 *Gallons* 5 *Pints* is bought for 21,l. 1,s. 6,d. 2,f. what is that the *Pint*? *Facit* 5,d. $0\frac{652}{1041}$ f.

54 What is that the *Quart* or two pints? *Facit* 10,d. 1 $1\frac{261}{1041}$ f.

5 By dry measures.

55 What are 47, *quart.* 5 *buſhels* 3, *pe.* worth at 4,s.8,d the *buſhell*? *Facit* 89,l. 1,s.6,d.

1, *bu.*	.125	—0.90309
4,s.8,d.	.23333	—1.632 02
47, *qu.* 5, *bu.* 3, *pe.*	47.718	1.67869
		0.04667
89,l.1,s.6,d.	89.075	0.94976

56 What are they worth at 1,s.2,d. the *peck*? *Facit* 89,l.1,s.6,d.

57 What are they worth at 3 $\frac{8}{16}$ f. the *pint*? Here reduce 3 $\frac{8}{16}$ f. to .0036458, *viz.* by adding .0005208 (the *proportionall* part of $\frac{8}{16}$ f.) to .003125 (the *Decimall* of 3,f.) Now to finde what part of .0010416 (the *Decimall* of 1,f.) you are to add unto .003125, for $\frac{8}{16}$ of a farthing, uſe this *proportion* following.

As 16 the *Denominator* of the Fraction propounded, is to .0010416, the *Decimall* of 1, f.

So is 8, the *Numerator* of the ſame fraction, to .80005208 the *proportionall* part anſwerable to $\frac{8}{16}$ f. which ought to be added to .003125 (the *Decimall* of 3, f.) as aforeſaid: for

As 16		1.20412
To	.0010416	——2.91230
So 8.		0.90309
		——2.07921
To	.0005208	——3.28333
		71667

This done, if you proceed to the resolution of the *question*, you shall finde the *facit* (as in the former *Examples*) to be 89,l.1,s.6.d.

1, *pi.*	.0019531	——2.70927
3 $\frac{8}{16}$ f.	.0036458	——2.43820
47.5.3.	47.718	1.67869
		——0.75951
89.1.6.	89.075	1.94976

I have thought convenient here by this *Example* to expresse the way how to reduce the fractions of *farthings* to *Decimals*, because in imitation thereof you may likewise reduce the fractions of *shillings* and *pence*, as also of the other fractions produced in the *Tablets* of *waight*, *measure*, *time*, &c. as occasion shall require. *Sat verbum sapienti.*

58 A man buyes 47,*qu.*5, *bu.* 3· *pe.*for 89,l. 1,s. 6,d. what is that the *buſhell*? *Facit* 4,s.8,d.

59 What is it the *pecke*? *Facit* 1,s.2,d.

60 What is it the *pint*? *Facit* $3\frac{5208}{10416}$ f. which is equivalent to $3\frac{8}{16}$ f.

61 One buyes a parcell of *Corne* at 4,s. 8,d. the *buſhell*, what is that the *pecke*? *Facit* 1,s. 2,d.

62 What is it the *pint*? *Facit* $3\frac{5208}{10416}$ f.

Vide ſupra exam. 57.

63 One buyes a parcell of *Muſtard-ſeed* at $3\frac{5208}{10416}$ f. the *pint*? what is that the *pecke*? *Facit* 1,s. 2,d.

64 What is it the *buſhell*? *Facit* 4,s 8,d.

65 A man buyes *ſalt* at 1,s.2,d.the *pecke*? what is that the *buſhell*? *Facit* 4,s. 8,d.

66 What is it the *pint*? *Facit* $3\frac{5208}{10416}$ f.

In the next place ſhould follow *examples* of things meted by long meaſures, *viz.* by *Yard* and *Ell*, but becauſe all the varieties of that kinde, which are now in *uſe*, are alreadie ſufficiently *diverſified* in the 7, and 8 chapters afore going, we intend to paſſe to the next, *viz.* to ſuch *queſtions*, as concerne things meaſured by *Time*.

67 What

67 What is due for a *Penſion* of 3,l.6,s. 8,d the *moneth* (conſiſting of 28 *dayes*) being areer or behinde 5 *yeeres*, 3 *moneths*, and 17 *dayes*? *Facit* 230,l. 2,s. 8,d. 6 By time.

28,*da.*	.076714	——1.11513
3,l.6,s.8,d.	3.3333	0.52288
3*y*.3,*m*.17,*d*.	5.2965	0.72398
		1.24686
230,l.2,s.8,d.	230.13	2.36199

68 What is due for a *Penſion* of 16,s. 8,d. the *weeke* (or 7 *dayes*) being behinde the ſame time? *Facit* 230,l 2,s. 8,d.

69 What is due to a *Captain* for his *pay* being behinde 7 *moneths*, and 21 *dayes* at the rate of 1,l.6,s. 8,d. the *day*? *Facit* 311,l. 17,s. 11,d.

70 The charges of a *Noblemans* houſe amount in 5, *yeeres* 3, *moneths* 17, *dayes* to 7325,l. 10,s. 6,d. what is that the *moneth*, accounting 28 *dayes* to the *moneth*? *Facit* 120,l. 11,s. 8,d.

71 What is it the *week*, or 7 *dayes*? *Facit* 30,l. 2,s. 11,d.

72 What is it the *day*? *Facit* 4,l. 6,s. 1,d. $2\frac{5}{10}$ f.

73 The

73 The expenſes of a *moneth* or 28 *days* amount to 120,l.11,s.8,d. what is that the *week*? *Facit* 30.l.2,s.11,d.

74 What is it the *day*? *Facit* 4,l.6,s. 1,d.2 $\frac{5}{10}$ f.

Videſupra exam. 57.

75 The expenſes of a *day* amount to 4,l. 6,s.1,d. 2 $\frac{5}{10}$ f. what is that the *week*? *Facit* 30,l.2,s.11,d.

76 What is it the *moneth* of 28 *days*? *Facit* 120, l.11,s.8,d.

77 The expenſes of a *week* amount to 30,l. 2,s.11,d. what is that the *moneth* of 28 *days*? *Facit* 120,l.11,s.8,d.

78 What is it the *day*? *Facit* 4.l.6.s. 1,d.2 $\frac{5}{10}$ f.

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79 What is the price of 5 *groſſe* 7 *dozen*, and 5 *pair* of Gloves at 13,s,6,d. the *dozen*? *Facit* 43,l.10 s.2,d.

7 By the dozen.

1,*doz.*	.083333	—1.07918
13.s.6,d.	.675	——0.17069
5,*gr.*7,*doz.* 5.*pai.*	5.618	0.74960
		0.57891
45,l.10,s.2,d.	45.508	1,65809

80 What

80 What do they amount vnto at 1,s. 1,d. 2,f. the *paire* ? *Facit* 45,l. 10,s. 2,d.

81 One buyes 5,*gr.* 7,*dozen*, 5, *paire* of Gloves for 45,l. 10,s. 2,d. what is that the *dozen* ? *Facit* 13.s. 6,d.

82 What is that the *pair* ? *Facit* 1,s. 1,d. 2,f.

83 If a *dozen* coſt 13,s. 6,d. what will *one* coſt ? *Facit* 1,s. 1,d. 2,f.

84 If *one* coſt 1,s. 1,d. 2,f. what will a *dozen* coſt ? *Facit* 13,s. 6,d.

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85 How much *ſterling* money may I have for 1942,l. 7,s. 4,d. *tourn.* when 10,s. *tourn.* make 1,s *ſterling*? *Facit* 194,l. 4,s. 8,d. *ſterl.* Reduction. 1 Of money.

10,s. *torun.*	.5	-0.30103
1,s. *ſterl.*	.05	-1.30103
1942,l.7,s.4,d, *tourn.*	1942.36	3.28834
		1.98731
194,l.4,s.8,d, *ſterl.*	194.23	2.28834

86 Unto how much *ſterl.* money do 49 *Spaniſh* Piſtolets amount when 5 of thoſe

thoſe *Piſtolets* make 3,l. 13,s. *ſterl.*? *Facit* 35,l. 15,s. 6,d. *ſterl.*

87 Unto how much *ſterling* money do 365 *Quart d' Eſcus* amount, when 5 *Quart d' Eſc.* make 8,s. *ſterling*? *Facit* 29,l. 4,s. *ſterling.*

88 How many *Quart d' Eſcus* may I have for 29,l. 4,s *ſterl.* when 5 *Quart d' Eſcus* amount to 8,s. *ſterling*? *Facit* 365, *Quart d' Eſcus.*

2 Of waights *Vide ſupra l.1.ch.1.r.34.*

89 Unto how much (*Troy waight*) do 5,*C.* 3,*qu.* 17,*lb.* (*Averdupois waight*) amount, when the *lb. Averdupois* makes 1,*lb.* 2,*Ounces* 12,*pen. Troy*? *Facit* 804,*lb.* 2 *ounc.* 8,*p.*

1,*lb.*	.0089285	—2.04922
1.2.12.	1.2166	0.08515
5.3.17.	5.9017	0.77100
		0.85615
804.2. 8.	804.2	2.90537
	16667	
	03333	

90 Unto

90 Unto how much *Averdupois great waight* doe 804, *℔.2, ounc.* 8, *p. Troy* amount, when 1, *℔.2. ounces* 12, *p. Troy* make 1, *℔. Averdupois*? *Facit* 5, *C.* 3, *qu.* 17, *℔.*

91 How much waight at *Rovan* do 365. *℔. Averdupois* make, when 100, *lb.* at *Rovan* make 114 $\frac{1}{4}$ *lb. Averdupois*? *Facit* 319 $\frac{84}{100}$ *lb.* of *Rovan.*

92 If 100 Ells of *Antwerpe* make 75 yerds of *London*, how many yerds *London-measure* will 27, Ells of *Antwerpe* make? *Facit* 20 $\frac{1}{4}$ yerds. 3 Of measures.

100.	2.00000
75.	1.87508
27.	1.43139
	3.30647
20.25	1.30647.

93 How many yerds (*London measure*) are 125 Ells of *Lions*, when the Ell of *Lyons* makes 1 $\frac{1}{4}$ yerds at *London*? *Facit* 156 $\frac{1}{4}$ yards.

Chap. 16.

The Rule of Three Inverse.

Videl. 1 ch. 22 pu. 2 Item l. 2 ch. 7 & 8.

I IF when *Wheat* is sold for 12,s. the *Quart* the *halfe-penny white loafe* ought by the *statute* to weigh 1,*lb*. 1,*ounc*. 12,*p. waight*, what must the *halfe-penny white loafe* weigh by *equity* of the same *statute* when *Wheat* is sold for 1,l. 6,s. 8,d. the *Quarter*? *Facit* 6, *ounc*. 2,*p*. 10 $\frac{9}{17}$ *gr*.

12,s.	.6	—0.22183
1,*lb*,1, *ounc*. 12,*p*.	1.13333	0.05438
		—0.16745
1,l. 6,s. 8,d.	1.33333	0.12402
6,*ou*. 2,*p*. 10, $\frac{9}{10}$ *gr*.	.51015	—0.29237
	5	70763
	01015	
	00833	
	00182	
	00173	
	00009	

2 If

2 If 10 horſes in 4 *moneths* and 16 *dayes* eat up 85, *buſhels* of provender, How ſoon will 27 horſes conſume the ſame quantity of provender? *Facit* 1 *moneth* 20 *dayes* accounting 30 $\frac{5}{13}$ *per menſ.*

3 If 17 *Pioners* are able to performe a piece of *worke* in 1 *moneth* 14 *dayes*; How many *Pioners* are neceſſary to have ſo *much worke* finiſhed in 15 *dayes*? *Facit* 49·654, that is, 50 *Pioners*; becauſe there can be no *fractions* of men.

4 In a town *beſieged* there are 3425 *Souldiers*, who have *victuals* onely for 3 *moneths* and 15 *dayes*, and yet they muſt be conſtrained to indure the *ſiege* 5 *moneths*; The *queſtion* is how many of theſe *Souldiers* muſt depart out of the towne, to the end there may be ſufficient *victuals* for the reſt during the *ſiege* of 5 *moneths*? *Facit*, 2393 *Souldiers*.

So that the *Souldiers*, which are to endure the *ſiege* for 5 *moneths* muſt onely be 1032, *viz.* the *remainder* of 2393 deducted out of 3425.

5 If 245,l. 10,s. ſerve 8 *Students* 1 *yeere*, and 2 *moneths*: how long will ſo much money laſt 3 *Students*? *Facit* 3 *yeers*, 1 *moneth*, 10 *dayes*, accounting 30 $\frac{5}{13}$ *per menſ.*

6 How

6 How much *Pluſh* is neceſſary to line a *Cloak*, that takes up 5, *yards* 1, *qu.* 2 *nails* of ſtuffe 3, *qu.* 1 $\frac{1}{2}$ *nail* broad; when the *Pluſh* carries 2, *qu.* $\frac{3}{4}$ *nail* in breadth? *Facit* 8, *y.* 1, *qu.* 0 $\frac{3}{4}$ *nail.*

7 Unto how many *Florins* do 487 *Dollers* amount, accounting the *Dollers* to conſiſt of 28 $\frac{1}{2}$ *Patars* a piece, and the *Florins* of 20? *Facit* 694 *Florins ferè.*

Chap. 17.

The Double Golden Rule Direct.

Videl, 1 *ch.* 23 *r.* 9. *item. ch.* 25, *r.* 2.

I. IF the *pay* of 47 *Horſemen* amounts in 3, *months* 7 *dayes*, to 572, l. 7, s. 4, d. what will the *pay* of 9 *horſe* come to in 1, *yeere* 2, *moneths.* 7, *dayes*? *Facit* 485, l. 17, s. 6, d.

47——572,l. 7,s. 4,d.—9
3,*m.* 7,*da.* 1,*y.* 2,*m.* 7,*da.*

9. *horſemen*	9.	0.95426
1. 2. 7.	1.1858	0.07401
572. 7. 4.	572.3666	2 75770
		3.78597
47, *horſemen*	47.	1.67211
3. 7.	.269178	-0.56997
		1.10214
485. 17. 6.	482.87	2.68383

2 If 3 *Labourers* in 2 *moneths*, and 12 *dayes* threſh out 1 [illegible], *quarters*, 3 *buſhels* 2½ *pecks*; How much will 7 *Labourers* threſh out in 24 *dayes*? *Facit* 81,*qu.* 0,*bu.* 2¾ *pecks*.

3 If the carriage of 6,*C.* 7,*lb.* 143 *miles* coſts 5,l. 16,s. 8,d. what will the carriage of 17¾*C.* 15,*lb.* 6 *ounce* 84 *miles* amount unto? *Facit* 10,l. 2,s. 2,d.

4 What is the value of a piece of *Tapiſtrie*, which is 27¾ *Flemiſh Ells* long, and 3¼ broad, when another piece of the ſame *fineneſſe*, that is 19½ *Ells* long and 2¾ broad, coſts 8,l. 7,s. 10,d? *Facit* 14,l. 2,s. 3,d.

CHAP.

Chap. 18.

The double Golden Rule Inverse.

Videl, 1 ch. 24 Item. ch. 25 r. 3.

1 IF the carriage of 6,*C*.7,*lb*. 143*miles* costs 5,l. 16,s.8,d. How far may one have 17 ¾ *C*. 15,*lb*. 6, *ounc*. carried for 10,l. 2,s. 2,d. *Facit* 84 *miles*.

Examples of this rule, when the inverse proportion is found,

1 In the uppermost line.

6,*C*.7,*lb*.——143——17¾*C*.15.*lb*.6,*ounc*.	5,l. 16,s. 8,d.	10.l. 2,s. 2,d.	
6. 7.		6.0625	0.78170
10. 2. 2.		0.108	1.00469
143. *miles*.		143.	2.15536
			3.94275
17¾ 15. 6.		17.887	1.25253
5. 16. 8.		5.8333	0.76592
			2.01845
84 *miles*		84.	1.93430

2 If 3 Labourers are able in 2 moneths, and 12 dayes to thresh out 105 quarters, 3 bushels, 2½ pecks, how many Labourers are

are neceſſary to have 81, *qu.* 0, *bu.* 2¾ *pecks* threſht out in 24 *dayes*? *Facit* 7, *Labourers.*

3 If the pay of 9 *horſemen* in 1, *yeere* 2, *moneths* 7, *dayes* amounted to 485, l. 17, s. 6, d. How long may I retain 47, *horſe* for 572, l. 7, s. 4, d.? *Facit* 3, *m.* 7, *da.* accounting 30 $\frac{5}{12}$ dayes *per menſem.* 2 In the lower line.

415, l. 17, s. 6, d – 1, *y.* 2, *m.* 7, *d* – 572, l. 7, s. 4, d
9, *Horſe* 47, *Horſe.*

415. 17. 6.	485. 87	2.68383
47.	47.	1.67211
		4.35594
572. 7. 4.	572, 366	2.75770
9.	9.	0.95426
1, 2. 7.	1.1858	0.07401
		3.78597
0. 3. 7.	·26917 —	0.56997
	25	43004
	01917	

4 If 13 *horſe* in 1 *moneth* (accounting 28 *dayes per menſem*) conſume 73, *buſh.* 1 $\frac{1}{3}$ *pecke*,

$1\frac{1}{2}$ *peck* or (which is all one) 9, *qu.* 1, *buſhell* $1\frac{1}{2}$ *peck* of *provender*; How long will 34 *qu.* 5, *bu.* 3, *pec.* laſt 25 *horſes*? *Facit* 1, *moneth* 24, *dayes* accounting 30, $\frac{5}{12}$ *per menſ.*

Chap. 19.

Rules of Plurall Proportion.

Vide ſupra l.1.c.26.r.1.

I. How many *yards* of *London* make 27 *Ells* of *Antwerpe*, when 100 *Ells* of *Antwerpe* make 60 *Ells* of *Lions*, and 20 *Ells* of *Lions* make 25 *yards* of *London*?

To reſolve this *queſtion* you muſt order the *termes propounded* into two ſingle rules of *Three direct*, as followeth,

I. If 20 *Ells* of *Lions*, make 25 *yards* of *London*, what will 60 *Ells* of *Lions* make? *Facit* 75 *yards* of *London.*

II. If 100 *Ells* of *Antwerpe* make 60 *Ells* of *Lions*, and by conſequent 75 *yards* of *London* how many *yards* of *London* do 27 *Ells* of *Antwerpe* make? *Facit* 20 $\frac{1}{4}$ *yards* of *London.*

20.	1.30103
25.	1.39795
60.	1.77816
	3.17611
75.	1.87508
100.	2.00000
75.	1.87508
27.	1.43139
	3.30647
20.25	1.30647

But if you desire yet to *abridge* the operations of this kind, deduct the sum of the Logarithmes of the *first termes* out of the sum of the Logarithmes of all the *mean termes*; that done, the *remainder* is the Logarithme of the *terme required*: yet this rule holds onely true, when all the Logarithmes of the *numbers propounded* are *perfect*, as in this *example*; for otherwise when the Logarithmes of any of the *termes* in *question* are *defective*, you are to use them according to their *nature*, and as you have been formerly instructed.

25.	1.39795
60.	1.77816
27.	1.43139
	4.60750
20.	1.30103
100.	2.00000
	3.30103
20.25	1.30647
25	
0	

2 How many *Ells* of *Frankefort* make 42 $\frac{1}{2}$ *Ells* of *Vienna* in *Auſtria*, when 35 *Ells* of *Vienna* make 24 at *Lions*, 3 *Ells* of *Lions* 5 *Ells* of *Antwerpe*; and 100 *Ells* of *Antwerpe* 125 *Ells* at *Frankefort*? *Facit* 60.37.

I.

I. 100——125——5

II. 3—— ——24

III. 35—— ——42¼

125.	2.09691
5.	0.69898
24.	1.38025
42,25	1.62582
	5.80196
100.	2.00000
3.	0.47711
35.	1.54406
	4.02117
60.37	1.78079

3 If ½ *Piſtolet* of *Spaine* is valued at 3,l. 13,s. 6,d. *Tournois*; 6,l. *Tourn.* at 14,s. *Flemiſh:* And 28,l. 14,s. 7,d. *Flemiſh* at 24,l. 12,s. 6,d. *ſterling*, How many *Piſtolets* ought I to receive for 72,l. 6,s. 9,d. *ſterling*? *Facit* 98.42 *Piſtolets.*

3,l. 13,s. 6,d. *tourn.*—½ *Piſtol.*—6,l. *Tour.* 14,s. *Fle.*—— ——28,l. 14,s. 7,d. *Fle.* 24,l. 12,s. 6,d. *ſterl.*— —72,l. 6,s. 9,d. *ſt.*

In this *Example* 14,s *Flemiſh* notwithſtanding that it is one of the *firſt termes*, yet ought it to be transferred unto the *mean termes*, becauſe the Logarithme thereof is a *defective* : In like manner muſt ½ *Piſtolet* (being one of the *mean termes*) be ranked amongſt the *firſt termes* for the ſame reaſon.

4 If in 1 *yard* of *broad-cloth* ſold for 14,s. 7,d. payable at the end of 4 *moneths*, 17 *dayes*, there was gained after the *rate* of 16,l. 12,s. 6,d. in the 100,l. for 12 *moneths*, what did that *yard* of *cloth* coſt the *ſeller*? *Facit* 13,s. 8,d. 2,f. for the *proportions* are, as followeth.

I. If 100,l. in 1 *yeere* gain 16 l. 12,s. 6,d. what will it gain in 4, *mo.* 17, *dayes*? *Facit* 6.316,l.

II. Then adding the gain of 4, *mo.* 17, *dayes* unto the 100,l ſtock, ſay thus : If 106.316,l. ſtock, and gains came of 100,l ſtocke, of what ſtocke came 14,s. 7,d. ſtock, and gains? *Facit* 13,s. 8,d. 2,f. And ſo much that *yard* coſt the Draper.

55 A having $\frac{2}{5}$ of a *ship* and *fraight* expected from *Ligorne*, bequeathes his part thereof unto *B C* and *D* and dies; *B* and *C* sell their parts unto *E*, when the ship returns to *London* it is valued together with the *fraight* at 3725,l. 10,s. Now the *question* is how much thereof belongs to *E* and how much to *D*? *Facit* 993,l. 8,s. to *E*, and 496,l. 14,s. to *D*.

5——3725,l. 10,s.——2

3—— ——2

Chap. 20.

The Rule of Fellowship.

I. A And B were *sharers* in a parcell of *Merchandize*, for the purchase of which A laid out 13,l. 7,s. 4,d. and B 8,l. 9,s. 3,d. now upon sail of this *commodity*, they found that they gained clearly, 5,l. 17,s. 5,d. The *question* is, what part of the gaines belongs to A, and what to B? *Facit* A is to have 3,l. 11,s. 11,d. and

Vide l. 1 c. 6. Examples of the single rule of Fellowship.

and B 2,l. 5,s. 6,d. For theſe two ſums being *added* together, (by the 13 Rule of the 2 Chap. of the 1, Book) make 5,l. 17,s. 5,d. the *ſum* of the gaines, according to the 9 Rule of the 16. Chapter of the 1 Book.

13,l. 7,s. 4,d. / 8. 9. 3 / 21. 16. 7 } 5.17.5. { 13.7.4 − 3.11.11. / 8.9.3 − 2. 5. 6. / 5.17. 5.

21,l. 16,s. 7,d.	21.829	1.33903
5,l. 17,s. 5,d.	5.8708	0.76872
13,l. 7,s. 4,d.	13.3666	1.12601
		1.89473
3,l. 11,s, 11,d.	3.595	0.55570

21,l. 16.s. 7,d.	21.829	1.33903
5,l. 17,s. 5,d.	5.8708	0.76872
8,l. 9,s. 3,d.	8,4625	0.92750
		1.69622
2,l. 5,s. 6,d.	2.276	0.35719

2 Three

2 Three *Merchants, viz.* A B and C. having entred *Company*, A puts in towards the *ſtocke* 375,l. B 138,l. and C. 57,l. 10,s. now the cleare *gain* that ariſeth upon this *ſtocke*, when they make their *account*, is 98,l. 3,s. 4,d. I demand what part of this *gain* each ſeverall *Merchant* is to have according to the rate of his *Adventure*: *Facit* A is to have 64,l. 10,s. 6,d. B, 23,l. 14,s. 11,d. and C 9,l. 17,s. 11,d.

375.	98,3,4,	375.	——64.10.6.
138.		138.	——23.14.11.
57.10		57.10,	——9.17.11.
570.10			98. 3. 4.

3 A B and C buy 60 *Tun* of *Wine* at 20,l. the *Tun*: of this bargain A deſires to have $\frac{1}{2}$: B $\frac{2}{5}$: and C $\frac{3}{8}$: Now the *queſtion*, is, how much each of theſe ought to pay according to that *rate*: To reſolve this *queſtion*, you muſt firſt reduce the *fractions* propounded into *Decimals*, either by the 2 *rule* of the 12 Chap. of the 1 book, or elſe upon *view*, or by ſome of the *Tablets* produced in the ſame Chapter: Now $\frac{1}{2}$ the firſt of theſe *fractions* may be reduced to a *Decimall* upon *view*, *viz.* to

.5 for

.5 for $\frac{1}{2}$ and .5 are *equivalent* fractions, again $\frac{2}{5}$ is *equall* to $\frac{4}{10}$ and therefore $\frac{2}{5}$ and .4 are also of *equall value*, lastly $\frac{3}{8}$ being *equivalent* to $\frac{6}{16}$ may be reduced to a *Decimall* by the *Tablet* of *Averdupois little waight*, if there you take .375 the *Decimal* of 6 *ounces*: for $\frac{3}{8}$ or $\frac{6}{16}$ and .375 are *fractions* of *equall value*; having thus reduced those *fractions* to *Decimals*, take their *sum* for the *first terme*, and then proceeding as in the former *examples*, you shall finde, that of the 1200,l which is the price of the 60 *Tun* of *Wine*, A is to pay 470,l. 12,s. B 376,l. 9,s. 4,d. and C 352,l. 18,s. 8,d.

.5
.4
.375
1.275

1.275–1200 { .5 ——— 470,l. 12,s.
.4 ——— 376,l. 9,s. 4,d.
.375 — 352,l. 18,s. 8 d.
1200,l. 0,s. 0,d.

4 Three *Stationers*, *viz.* A B and C, print 500 *Copies* of a *Booke*, that consists of

of 40 *sheets*. Of this *Impression* A supplies $17\frac{1}{2}$ *sheets*, B 15 *sheets*, and C $7\frac{1}{2}$ *sheets*. Now the *Impression* being finished, the *question* is, how many of the 500 *Bookes* ought each *Stationer* to have according to the number of the *sheets*, that he brought in, to make the *Impression* perfect. In this *demand*, it is evident, that 40 (*viz.* the number of the *sheets* in the whole *Impression*) is the *first terme*, likewise 500 (the number of the Printed *copies*) the *second terme*, and as for the *third termes*, they are the particular *sheets*, that each *Stationer*, supplied: Now therefore if you proceed, as in the former *Examples*, the first *Proportion* will be this.

40.	40.	1.60206
500.	500.	2.69897
$17\frac{1}{2}$	17.5	1.24305
		3.94202
218.75	218.75	2.33996

So that I finde, the part of the *Impression* due to A, to be 218 intire *Copies*, or *bookes*, and besides $\frac{75}{100}$ of a *booke*: And now if you desire to know, how many odd *sheets* the *Decimall* .75 represents, pursue this *Proportion* following.

100.

100.	2,00000
40.	1.60206
75.	1,88650
	3.48856
30.	1.48856

I conclude therefore, that the *intire part*, belong to A, is 218 *bookes*, and 30 *ſheetes*: likewiſe proceeding in the ſame order, I finde the *portion* of the *Impreſſion* belonging to B, to be 187.5 (*viz.* 187 *bookes* and 20 *ſheets*) and the part appertaining to D, to be 93.75, or 93 *bookes* and 30 *ſheetes*. Now for *triall* hereof adde the three *termes diſcovered* together, *viz.* 218.75 + 187.5 + 93.75: this done, you ſhall finde their *totall* to amount to 500, the number of the printed *Copies*, as plainly appears by the operation following.

218.75
187.5
93.75
500.00

Here

Here when the Impreſſion conſiſts of more then 500 Copies, work as in the premiſed example, ſuppoſing the Impreſſion to conſiſt of 500 Copies onely; But when the whole operation is performed, if there are 1000 Printed copies double the termes required, if 1500 treble them, if 2000 multiply them by four, &c.

5 A, B, and C, fraighted a ſhip with diverſe *commodities* amounting to the *value* of 2734, l. 16, s. of which *ſumme* A disburſed 1624, l. 8, s. 6, d. B, 743, l 6, s. 8, d. and *C*, the reſt: Now by *reaſon* of divers ſtorms and tempeſts at Sea in the paſſage home, the *Mariners* were conſtrained to caſt *over* boord ſo much of theſe *commodities* as amounted in the whole to 537, l. 4, s. 6, d. The *demand* is, what part *each* of theſe *Merchants* ought to bear of that *loſſe? facit A*, is to loſe 319, l. 2, s. 0, d. *B* 146, l. 0, s. 6, d. and *C* 72, l. 1, s. 10. d.

1624. 8. 6.
743. 6. 8.

2367.15. 2.
2734.16. 0.

367. 0.10.

2734,l. 16,s.——537,l. 4,s. 6,d.

1624,l. 8,s. 6,d——319. 2. 0.
743,l 6,s. 8,d——146. 0. 6.
367,l.0,s. 10,d—— 72. 2. 0.

537. 4. 6.

6 Three men were *ſharers* in a *commoditie*, for the *purchaſe* whereof *A* the *firſt* laid out 5,l 12,s. *B* 3,l 9,s. 6,d. and *C* 2,l. 5,s. 8,d. Now upon the ſail hereof theſe *Merchants* finde that they loſe 2,l. 3,s. 7,d. of their *principall*; The *demand* is, what is the particular *loſſe* of each party? *Facit* A loſeth 1,l. 1,s. 6,d. *B* 0,l. 13,s. 4,d. and *C* 0,l. 8,s. 9,d.

5.

5. 12. 0.
3. 9. 6.
2. 5. 8.

11. 7. 2

11,72.–2.3.7. { 5. 12. 0.—1. 1. 6.
3. 9. 6.– 0. 13. 4.
2. 5. 8.– 0. 8. 9.

2. 3. 7.

Examples of the double rule of Fellowship.

7 *A B C* hold a paſture *in common*, for which they pay 95,l 6,s. 8,d *per annum*: In this paſture *A* had 42 *Oxen* went 37 *dayes*, *B* had 19 there 28 *dayes*, and *C* fed 26 *Oxen* there 28 *dayes*: The *demand* is, what part of the *rent* each of theſe *tenants* ought to pay: *Facit A* ought to pay 44,l. 6,s. 9,d. *B* 30,l. 14,s. 1,d. and *C* 20,l. 5,s. 10,d.

43	58	28	1591
37	19	26	1102
301	522	168	728
129	58	56	3421
1591	1102	728	

3421--95.6.8. { 1591--*A*, 44. 6. 9.
1102--*B*, 30. 14. 1.
728--*C*, 20. 5. 10.
95. 6. 8.

8 *A*, *B*, and *C*, enter *Company* the first *day* of *May* 1627, at which time *A* disburſed for a parcell of *Merchandize* 132, l. 8, s, 7, d. *Item*, upon the 13 of *Septemb.* the ſame *yeare* (*viz.* 4 *moneths* and 13 *dayes* after they began *Company*) *B* laid out for another *Commodity* 82, l. 14, s. 3, d. *Item* upon the 3. of *July* 1628 (*viz.* 1 *year* 2 *moneths* and 3 *dayes* after their entrance into *Company*) *C* disburſed 207, l. 12, s. 9, d. for another parcell of *Merchandize*. Now theſe three *Merchants* caſting up their accounts upon the 1 of *May* 1629, finde that their clear *gaines* amount in thoſe two *yeares* to 152, l. 16, s. 10, d.

Here

Here the *Demand* is, how theſe *gaines* ought to be divided amongſt them, in ſuch ſort that *each* of them may have *his part* thereof, according to the *quantity* of his particular *ſtocke*, and the *time* that it was imployed? To reſolve this *queſtion*, you are firſt to finde how long *each party* imployed his particular *ſtocke*: And as for *A*, becauſe he diſburſed his money *preſently*, his *ſtocke* went two *compleat* years: but now to finde how long *B* and *C* imployed theirs, you are to deduct the *diſtance* of *time* comprehended betwixt their firſt *entrance* into *Company*, and the *date* of caſting each particular *ſtock* into *bank*, out of two *compleat* years: for *example*, B expended his 82. 14. 3. four *moneths* 13, *days* after they *began* their *Company*, therefore if I deduct 4 *moneths*, 13 *dayes*, out of 2 *yeares*, the *remainder* 1 *year*, 7 *moneths*, 17 *dayes*, is the *time* that *B* imployed his *ſtock*: In like manner the time that *C* imployed his *ſtock* was 0 *y.* 9 *m.* 27 *da.*

2, *y.* 0, *m.* 0, *da.*	2, *y.* 0, *m.* 0, *da.*
0. 4. 13.	1. 2. 3.
1. 7. 17.	0. 9. 27.

Having thus discovered the *time* how long each *Merchant* employed his *stocke*, multiply each *severall time* by his *respective stocke*, and then proceeding as in the last premised *example*, you shall finde, that of this *gain* there will be due to *A*.70,l.18,s.8,d. to *B*,36,l.2,s.0,d. and to *C*.45,l.16,s.2,d.

2.*y*.	2.	0.30103
132,l.8,s.7,d.	132.429	2.12200
	264.86	2.42303

1,*y*.7,*m*.17,*da*.	1.6299	0.21215
82,l.14,s.3,d.	82.7125	1.91756
	134.8	2.12971

0,*y*.9,*m*.27,*da*.	.82397	—0.08410
207,l.12,s. 9,d.	207.637	2.31725
	171.06	2.23315

264.86

264.86
134.8
171.06

570.72

570.72——152,l.16,s.10,d.——

264.86——70.18. 8.
1348 ——36. 2. 0.
171.06——45.16. 2.

152.16.10.

CHAP. 21.

The Rule of Alligation.

I. A Man mixeth 1 *Quarter*, 6 *bushels* of *Wheat* at 2,s.8,d. the *bushell*: and 5 *Quarters*, 3 *bushels*, 2 *pecks* of *Rie* at 2,s. 9,d. the *bushell*, with 6 *Quarters*, 2, *bu.* 1 *peck of Barley* at 1,s.1 ,d. the *bushell*: I demand what *one bushell* of this *Mistling* is worth? *Facit* 2,s.5,d. 1, $\frac{21}{84}$ f.

Vide lib. 1. *chap.* 27. Examples of Allegation mediall.

1,*bu.*	.125	—0.90309
3,s.8,d.	.18333	—0.73673
1,*qu.*6,*bu.*	1.75	0.24306
		—0.49367
	2.5671	0.40942

1,*bu.*	.125	—0.90309
2,s.9,d.	.1375	—0.86170
5,*qu.*3,*bu.*2,*pec.*	5.4375	—0.73542
		—0.12628
	5.9815	0.77681

1,*bu.*	.125	—0.90309
1,s.10,d.	.091666	—1.03773
6,*qu.*2,*bu.*1,*pec.*	6.2812	0.79807
		—0.23966
	4.6069	0.66343

qu.bu.pec.	*lb.*
1. 6. 0.	2.5671
5. 3. 1.	5.9815
6. 2. 3.	4.6069
13. 3. 3.	13.1555

The

The ſum of the quant. qu. 13.4687		1.12933
The tot. val. of the ſim. l. 13. 1555		1.11910
1, *Buſhell*	.125.	—0.90309
		0.21609
The mea. pr. of 1, *buſh.* 2.5.1, $\frac{21}{64}$ f. 12208		—0.91332
		08668

Againe, what is one *Quarter* of that *Maſſe of Corn* worth? *Facit* 19,s.6,d.1,f.

If 13.4687 *Quarters*	1.12933
Give 13.1555.*l.*	1.11910
What will one qu. yield?	0.00000
	1.11910
Facit 19,s.6,d.1,f. .9767	—0.01023
	.98977

2 A *Goldſmith* having three differing ſorts of *Gold, viz.* 7, *lb.* 3 *ounces of* 16 $\frac{1}{2}$ *Carects fine:* Item 3, *lb.* 11 *ounces* 5, *p.* of 19 $\frac{3}{4}$ *Carects:* and, 1, *lb.* 7, *ounces* 0, *p.* 15, *gr.* of 22 $\frac{1}{4}$ *Carects* fine, is deſirous to have them all melted into one *maſſe*, and to know before-hand what fineſſe *one pound* thereof

1,*bu.*	.125	—0.90309
3,s.8,d.	.18333	—0.73673
1,*qu.*6,*bu.*	1.75	0.24306
		—0.49367
	2.5671	0.40942

1,*bu.*	.125	—0.90309
2,s.9,d.	.1375	—0.86170
5,*qu.*3,*bu.*2,*pec.*	5.4375	—0.73542
	5.9815	—0.12628
		0.77681

1,*bu.*	.125	—0.90309
1,s.10,d.	.091666	—1.03773
6,*qu.*2,*bu.*1,*pec.*	6.2812	0.79807
		—0.23966
	4.6069	0.66343

---

qu.bu.pec.	*lb.*
1. 6. 0.	2.5671
5. 3. 1.	5.9815
6. 2. 3.	4.6069
13. 3. 3.	13.1555

The

The ſum of the quant. qu. 13.4687		1.12933
The tot. val. of the ſim. l. 13. 1555		1.11910
1, *Buſhell*	.125.	—0.90309
		0.21609
The mea. pr. of 1, *buſh.* 2.5.1 $\frac{21}{64}$ f. 12208		—0.91332
		08668

Againe, what is one *Quarter* of that *Maſſe of Corn* worth? *Facit* 19,s.6,d.1,f.

If 13.4687 *Quarters*	1.12933
Give 13.1555.*l.*	1.11910
What will one qu. yield?	0.00000
	1.11910
Facit 19,s.6,d.1,f. .9767	—0.01023
	.98977

2 A *Goldſmith* having three differing ſorts of *Gold, viz.* 7, *lb.* 3 *ounces of* 16 $\frac{1}{1}$ *Carects fine:* Item 3, *lb.* 11 *ounces* 5, *p.* of 19 $\frac{3}{4}$ *Carects:* and, 1, *lb.* 7, *ounces* 0, *p.* 15, *gr.* of 22 $\frac{1}{4}$ *Carects* fine, is deſirous to have them all melted into one *maſſe*, and to know before-hand what fineſſe *one pound* thereof

(and by consequent the *Whole masse*) will bear: *Facit* 18 $\frac{217}{1000}$ *Carects* fine.

1, *lb.*	1.	0.00000
16 $\frac{1}{2}$ *car.*	16.5	1.21748
7, *lb.* 3. *ounces*	7.25	0.86036
	119.63	2.07784

1, *lb.*	1.	0.00000
16 $\frac{3}{4}$ *car.*	1975	1.29560
3. *lb.* 11, *ounc.* 5, *p*	3.9375	0.59522
	77.77	1.89082

1, *lb.*	1.	0.00000
22 $\frac{1}{4}$ *car.*	22.25	1.34735
1, *lb.* 7, *ounc.* 0, *p.* 15. *gr.*	1.5859	0.20030
	35.2559	1.54765

---

lb.

lb.	*ounces*	*p.*	*gr.*	*Car.*
7.	3.	0.	0.	119.63
3.	11.	5.	0.	77.77
1.	7.	0.	15.	35.289
12.	9.	5.	15	232.689

12, *lb.* 9, *ounc.* 5, *p.* 15, *gr.*	12.7734	1.10630
232.689 *Carects*	232.689	2.36674
1, *lb.*	1.	0.00000
		2.36674
18.217, *Car.*	18,217	1.26044

The ſame *Facit* may be likewiſe diſcovered, if inſtead of 1, *lb.* you uſe 1, *ounce* for the *firſt terme* in the three firſt *proportions*, and for the third in the *laſt*.

Examples of Alternation partiall.

3 A man is determined to mix 10 *buſhels*, 3 *pecks* of *wheat* at 2,s.8,d. the *buſhel*, with *Rie*, of 2,s.9,d. the *buſhell*, with *Barley* of 2,s.2,d. the *buſhell*, and with *Oats* of [illegible] *ſhell*: I demand how much

much *Rie*, *Barley* and *Oats*, muſt he add unto the 10 *buſhels*, 2 *pecks* of *wheat*, that the *mixture* of them all together may be afforded at 2,s.6,d the *buſhell*? *Facit* 2 *buſhels* $3\frac{1}{4}$ *pec.* $3\frac{81}{195}$ *pints* of *Rie*, 2,*bu.*0 $\frac{1}{2}$ *peck* $1\frac{115}{195}$ *pints* of *Barley*, and 1,*qu.*2,*bu.*0,*pec.* 2,*pints* of *Oats*.

s.	d.
3.	8.
2.	6.
1.	2.

s.	d.
2.	2.
2.	6.
0.	4.

2.	9.
2.	6.
0.	3.

1.	3.
2.	6.
1.	3.

2.6 { 3.8, 2.9, 2.2, 1.3 }

1,s.3,d.
0,s.4,d.
0,s.3,d.
1,s.2,d.

1,s.3,d.

1,s.3,d.	.0625	——1,20409
0,s.4,d.	.016666	——1.77822
1,*qu.* 2 *bu.* 3 *peck.*	1.34375	0.12829
		——1,64993
2,*bu.* 3. $\frac{1}{4}$ *pec.* 3 $\frac{281}{1575}$ *pi.*	.35822	——0.44584
		55416

1,s.3,d.	.0625	——1.20409
0,s.3,d.	.0125	——1.90308
1,*qu.* 2,*bu.* 3 *peck.*	1.34375	0.12829
		——1.77479
2,*bu.* 0 $\frac{1}{2}$ *pec.* 1 $\frac{115}{1575}$ *pi.*	.26872	——0.57070
		42930

1,s.3,d.	.0625	——1.20409
1,s.2,d.	.058333	——1.23410
1,*qu.* 2.*bu.* 3,*pec.*	1.34373	0.12829
		——1,10581
1,*qu.* 2,*bu.* 0,*pe.* 2,*p.*	1.2538	0.09828

4 A *Goldſmith* having 19, *ounces* 3, *p.* 17, *gr.* of gold 22 *Carects* fine, is deſirous to mix therewith gold of 18 $\frac{1}{2}$ *Carects*, and other

other gold of $16\frac{3}{4}$ *Carects* fine: in such sort that the whole *masse* of gold so mixed may beare 20 *Carects* fine: Now the *demand* is how much gold of $18\frac{1}{2}$ *Carects*, and how much of $16\frac{3}{4}$ *Carects* must he take to fulfill his *desigue*? *Facit*, 8 *ounces*, 1, *p.* 14, *gr.* of each sort.

Car. 22.	*Car.* 16.75
20.	20.
2.	3.25
	1.5
Car. 18.5	4.75
20.	
1.5	

20 { 22. / 18.5 / 16.75 }

1.5 + 3.25		4.75
2.		2.
2.		2.

4.75

4·75	4·75	0.67669
2.	2.	0.30103
1, ℔·7, *ounc*, 3·p·17·gr.	1.59878	0.20380
		0.50483
8, *ounc*. 1, p·14, gr.	.6732	—0.17186
	6666	82814
	0066	
	0041	
	0025	

5 A *Mint-maſter* hath 7, ℔.2, *ounc*.8 p. of gold 22 *Carects* fine, and 1, ℔.9, *ounc*. 13, p. 10, gr of 19.25 *Carects* fine, theſe *quantities* he would ſo mix together, that every *pound* of the *intire maſſe* might bear 20 *Carects* fine: Now the *queſtion* is, whether in this *mixture* any *Alloy* is neceſſary, and how much? To reſolve this *queſtion* you are firſt to ſearch a *meane* rate of their *mixture*, *viz*. how many *Carects* fine the *mixture* of thoſe two *quantities* will bear, which I find (according to the 2 *example* of this chapter) to be

be 21.45 *Carects*: wherefore the *meane* rate of their *mixture* being too *fine* (*viz.* 21.45 *Carects*, whereas it ſhould be but 20) appointing 20 *Carects* the *root*, or *mean rate*, I aſſigne 21.45 *Carects* for *one branch*, and 0 *Carects fine* (repreſenting the *Alloy*) for the *other branch*; and ſo proceeding as in the laſt premiſed *example* I finde, that 0, *lb.* 7, *ounces* 16, *p.* 17. *gr.* of *Alloy* are to be added unto thoſe *quantities* propounded, to the end that every *pound* of their *mixture* may beare 20 *Carects* fine, which is the reſolution of the *demand* propounded.

1, *lb.*	1.	0.00000
7, *lb.* 2, *ounces* 8, *p.*	7.1999	0.85733
22 *Carects*	22.	1.34244
	158,41	2.19977

1, *lb.*	1.	0.00000
1, *lb.* 9, *ounc.* 13. *p.* 10. *gr.*	1.8059	025670
19.25	19.25	1.28447
	34.77	1.54117

158.41

158.41	7.1999
34.77	1.8059
193.18	9.0058

9.0058	0.95453
193.18	2.28597
1.	0.000 0
	2.28597
21.45	1.33144

20 { 21.45) | 20
0. | 1.45

20.	1.30103
1.45	0.16138
9.0058	0.95453
	1.11591
0,lb.7,oun.16,p.17,gr. .6529	—0.18512
5833	81488
0696	
0666	
0030	

How the fineneſſe of ſilver is diſtinguiſhed, *Vide lib 2. chap. 15. Example 34.*

6 A *Goldſmith* having 38 *ounces 7, p.* of ſilver 11 *ounc. 6 peny weight* fine, would mix therewith other ſilver of 10 *ounces* 12 *p.* fine; *Item*, ſilver of 9 *ounces* 11, *p.* 14 *gr.* fine: and ſilver of *6 ounces, 9 pen.* fine, in ſuch ſort that the *entire Maſſe* thereof being melted together might beare 8 *ounces*, 10 *pen.* fine. Now the *Queſtion* is, how much of each of the other three *ſorts* propounded ought he to take, that he might accompliſh his deſigne? *Facit* 38 *ounces, 7, p.* or (which is all one) 3 *lb.* 2 *ounees* 7 *p.* of 10 *ounese*, 12 *p.* fine. *Item*, 3 *lb.* 2 *ounces* 7 *p.* of 9 *ounces* 11 *p.* 14 *gr.* fine; and 9 *lb.* 17 *p.* of the ſilver, that is *6 ounces 9 p.* fine.

11. 6. 0	9.11.14
8.10. 0	8.10. 0
2.16. 0	1. 1.14
10.12. 0	6. 6. 0
8.10. 0	8.10. 0
2. 2. 0	2. 1. 0

8.10	11. 6. 0.	2. 1. 0.
	10.12. 0.	2. 1. 0.
	9.11.14.	2. 1. 0.
	6. 9. 0.	2.16. 0.
		2. 2. 0.
		1. 1.14.
		5.19.14.

2,*ounc.*1,*p.*	.17082	0.76748
5,*oun.*19,*p.*14,*gr.*	.49825	0.30253
3,*lb.*2,*ounc.*7,*p.*	3.19582	0. 50456
		c.20203
9,*lb.*17,*p.*	9.321	0.96951
	25	
	071	

7. A *Vintner* having divers ſorts of *Wines, viz.* ſome that ſtand him in 4,s. 2, d. the *Gallon*, other ſome of 3,s. 4, d. the *Gallon*, ſome again of 2,s. 3,d. the *Gallon*, and other ſome of 1,s. 8, d. the *Gallon*, is deſirous to fill a *Hogſhead*, conteining 63 *Gallons* with a mixture of

Examples of Alternation totall.

of these *wines*, which he may afterwards afford for 2, s. 8, d. the *Gallon*: How much of each sort ought he to take? *Facit* 17 *gallons*, 4 $\frac{3}{4}$ *pintes* of the first; 7 *gall.* 2 $\frac{1}{2}$ *pi.* of the second, 11, *gall.* 5 $\frac{3}{4}$ *pi.* of the third; and 26 *gallons*, 3 *pints* of the last sort.

s. d.	s. d.
4. 2	2. 3
2. 8	2. 8
1. 6	0. 5
3. 4	1. 8
2. 8	2. 8
0. 8	1. 0

s. d.		s. d.
4. 2.		1. 0.
2. 8 { 3. 4.		0. 5.
2. 3.		0. 8.
1. 8.		1. 6.
		3. 7.

3, s. 7, d.

3,s.7,d.	.17916	—0.74675
63,*gallons*	63.	1.79937
1,s.0,d.	.05	—1.30103
		0.49834
17,*gall.* $4\frac{3}{4}$ *pint.*	17.581	1.24509
3,s.7,d.	.17916	—0.74675
63,*gallons*	63.	1.79937
0,s.5,d.	.020833	—1.68127
		0.11810
7,*gall.* $2\frac{1}{2}$ *pint.*	7.325	0.86485
3,s.7,d.	.17916	—0.74675
63,*gallons*	63.	1.79937
0,s.8,d.	.033333	—1.47714
		c.32223
11,*gall.* $5\frac{3}{4}$ *pi.*	11.721	1.06898

3,s.7,d.	.17916	—0.74675
63,*gallons*	63.	1.79937
1,s.6,d	.075	—1.12494
		0.67443
26,*gall.* 3 *pi.*	26.372	1.42118

8 A *Goldſmith* hath divers ſorts of gold, *viz.* ſome of 22 *Carects*, other ſome of $20\frac{3}{16}$, again another ſort of $19\frac{1}{4}$, and yet another ſort of $17\frac{1}{2}$ *Carects*: The *queſtion* is how much of each ſort ought he to take to produce a *maſſe* of gold, which may weigh 64, *ounc.* 6, *p.* 19, *gr.* and may hold $21\frac{2}{16}$ *Carects* fine? *Facit*, of the firſt ſort 3, *lb.* 9, *ounc.* 14, *p.* 1, *gr.* and of each of the reſt 6, *ounc.* 4, *p.* 6, *gr.*

Note that $\frac{3}{16}$ and $\frac{2}{16}$ are reduced to Decimals by the Tablet of Averdupois little weight: for $\frac{3}{16}$ are as it were 3 ounces, and $\frac{2}{16}$ as 2, ounces of a pound Averdupois.

22.000	19.25
21.125	21.125
00.875	1.875
20.1875	17.5
21.125	21.125
00.9375	3.625

21.125 { 22. / 20.1875 / 19.25 / 17.5 }

.9375	6,4375
1.875	
3.625	
.875	
.875	
.875	
9,0625	

9.0625	9.0625	0.95729
5, *lb*. 4, *ounc*. 6, *p*. 19, *gr*.	5.3616	0.72929
6.4375	6.4375	0.80875
		1.53804
3, *lb*. 9, *ounc*. 14, *p*. 1, *gr*.	3.8085	0.58075
9.0625	9.0625	0.95729
5, *lb*. 4, *ounc*. 6, *p*. 19, *gr*.	5.3616	0.72927
.875	.875	—0.05797
		0,67130
6, *ounc*. 4, *p*. 6, *gr*.	.5176	0.28599
		71401

9. A *Goldſmith* hath divers ſorts of Silver, *viz*. ſome of 11, *ounc*. 13, *p*. fine, other ſome of 10, *ounces*, and another ſort of 8, *ounc*. 7, *p*. fine: The *demand* is, how much of *each ſort* he ought to take, and how much *Alloy*, to the end he may produce a *maſſe* of ſilver weighing 18, *lb*. 10, *ounc*. and bearing 6, *ounc*. 12, *p*. 13, *gr*. fine? *Facit*, he muſt take of *each* of the *ſorts* of ſilver 4, *lb*. 1, *ounc*. 18, *p*. 12, *gr*. and of the *Alloy* 6, *lb*. 4, *ounc*. 4, *p*. 12, *gr*.

ounc. p. gr.	*ounc. p. gr.*
11.13. 0.	8. 7. 0.
6.12.13.	6.12. 13.
5. 0.11.	1.14.11.
10. 0. 0.	0. 0. 0.
6.12.13.	6.12.13.
3. 7.11.	6.12.13.

6.12.13. × { 11.13.0, 10. 0.0, 8. 7.0, 0. 0.0 }

6.12.13.
6.12.13.
6.12.13.
5. 0.11.
3. 7.11.
1.14.11.
10.2.9.

26. 0. 0.

2,*lb.*6,*ounc.*	2.5	0.39794
18,*lb.*10,*ounc.*	18.833	1.27492
6,*ounc.*12,*p.*13,*gr.*	.55225	−0.25784
		1.01708
4,*lb.*1,*oun,*18,*p.*12,*gr.*	4.1604	0,61914

2,*lb.*

2,*lb.*6 *ounc.*	2.5	0.39794
18,*lb.*10,*ounc.*	18.833	1.27493
10,*ounc.*2,*p.*9,*gr.*	.84322	—0.07404
		1.20088
6,*lb.*4,*oun.*4,*p.*12,*gr.*	6.3521	0.80294

CHAP. 22.

The Rule of False.

THus have we explained the vſe of the Logarithmes in ſingle, and Comparative Arithmetique: in the laſt place ſucceeds their vſe of the Ruſe of Falſe.

1 *Example*, three Merchants, *viz.* A, B, and C, conſent together to buy a parcell of *Merchandize*, which coſts them 1032, l. 7, s. 10, d. and becauſe their *eſtates* are not *equall*, it is covenanted betwixt them, that in the *payment* of that *ſumme*, B ſhall pay a *third part* more then A, and C a *fifth part* more then B: The *demand* is how much *each* of theſe *Merchants* ought to pay of that ſumme? *Facit*, A is to pay 262, l. 9. s. 4, d. B 349, l. 19 s. 3, d. and C 419, l. 19, l. s. 3, d. Here let your three *ſup-*

*Vide lib.*1. *chap.*28. Examples of the rule of Single Poſition.

positiall numbers be 30,l. for A, 40,l. for B, and 48,l. for C, becauſe 40, exceeds 30, $\frac{1}{3}$ *part*, and 48, exceeds 40, $\frac{1}{5}$ *part*: now the *ſum* of theſe three *ſuppoſed terms* is 118, wherefore *I ſay* by the Rule of *three direct*.

118—1032.7.10 { 30—262.9. 4. for A,
40—349.19.3. for B,
48—419.19.3. for C,

1032.7.10.

118,l.	118.	2.07188
1032,l.7,s.10,d.	1032.39	3.01384
30,l.	30.	1.47712
		4.49096
262,l.9,s.4,d.	262.46	2.41908

118,l.	118,	2.07188
1032,l.7,s.10,d.	1032.39	3.01384
40,l.	40.	1.60206
		4.61590
349,l.19,s.3,d.	349.96	2.54402

118,l.

118.l.	118.	2.07188
1032,l.7,s.10,d.	1032.39	3.01384
48.l.	48.	1.68125
		4.69509
419,l.19,s.3,d.	419.96	2.62321

2 A Noblemans *Steward* buyes of a *Goldſmith* a parcel of ſilver plate, *viz.* 7, *lb.* 5, *ounces* 11, *p.* 17, *gr.* of white plate, and 10, *lb.* 7, *ounces* 3, *p.* 5, *gr.* of gilt plate, This *plate* being brought home, the *Steward* was demanded what the *gilt plate* coſt him an *ounce*, to which he *anſwered*, that he had *forgot*, but this he well *remembred*, that he diſburſed for the *gilt* and *white plate* all together 79,l.8,s.5,d. and that the *ounce* of *gilt plate* was half as dear again as the *ounce* of *white plate*, count you then (*quoth he*) what an *ounce* of the *gilt plate* is worth. To reſolve this *Probleme*, put caſe, that an *ounce* of the *white plate* coſt 5,s. and then *by conſequence* an *ounce* of the *gilt plate* muſt coſt 7,s.6,d. (becauſe 7,s.6,d. amounts to 5,s. and 2,s.6,d. more, that is, half 5,s.)

Now

See the 24 & 25 examples of the 15 Chapter of this Book.

Now to make *triall* whether you have gueſſed *right* or no, caſt up the *value* of 7,*lb*. 5,*ounces*, 11 *p*.17,*gr*. of *white plate* at 5,s. the *ounce*, which you ſhall finde to amount unto 22,l.7,s.11,d.2,f. likewiſe the *value* of 10,*lb*.7,*ounces*, 3,*p*.5, *gr*. at 7,s. 6,d the *ounce*, which comes to 47,l.13,s. 8,d. Theſe two *ſums* being added together amount unto 70,l.1,s.7,d.2,f. which ought to have been 79,l.8,s.5,d. if you had gueſſed *right*: wherefore repairing to the Rule of *three direct*, ſay *thus*: If 70,l. 1,s.7,d.2,f. are produced of the *Poſition* 5,s. of what are 79.l.8,s.5,d. produced? *Facit* 5,s.8,d.

70,l.1,s.7,d.2.f.	70.081	1.84560
5,s.	.25	—0.60206
79,l.8,s.5,d.	79.420	1.89994
		1.29788
5,s.8,d.	.28333	—0.54772
		45228

Hereupon you may conclude that the *white plate* was bought at 5,s. 8,d. the *ounce*: and now to know likewiſe at what *rate* the *gilt plate* was bought, you are but to add unto 5,s.8,d. half ſo much more,

viz.

viz. 2,s.10,d. for theſe *ſums* being added together amount unto 8,s.6,d. which is the *rate*, that the *Steward* paid for every *ounce* of the *gilt plate*. Now to prove whether you have *rightly* proceeded in the *reſolution* of this *queſtion*, or no; account what the 7, *lb*.5, *ounces* 11,*p*.17,*gr*. of *white plate* come to,at 5,s.8,d.the *ounce*, as alſo what the 10,*lb*.7,*ounces* 3,*p*.5,*gr*.of *gilt plate* amount to, at 8,s.6,d.the *ounce*: This done, you ſhall finde the *value* of the *white plate* to be 25,l.7,s.8,d. and the *value* of the *gilt plate* 54,l.0,s.9,d. now theſe two *ſums* being added together amount to 79,l.8,s.5,d. which agrees with the *totall*, that the *Steward* laid out for all the *plate* together: whereupon you may be confident, that the *reſolution* of the *queſtion* is truly performed.

3 What two numbers are they,whoſe $\frac{1}{4}$ and $\frac{2}{3}$ of the one, is equal to $\frac{3}{4}$ of the *other*? For *anſwer* of this *demand*, firſt, I make *choice* of a *number*, which may be eaſily divided into *quarters* and *thirds*, *viz.* 12. which hath 3 for $\frac{1}{4}$ and 8 for $\frac{2}{3}$, now the *ſum* of 3 and 8 is 11; again, I ſuppoſe 24 (or any other number at *pleaſure*, which may be readily divided into

quar-

Quarters) for the *second number* required, now ¼ of 24, are 18, which should be but 11 according to the *supposition* of the *first number*: wherefore addressing my self to the *Rule of Three direct*, I say, If 18 is produced of my *position* 24, of what is 11 produced? *Facit*, 14.667.

18.	1.25528
24.	1.38023
11.	1.04139
	2.42162
14.667	1.16634

So that I *conclude*, 12, and 14.667 to be two *such numbers*, as I look for, because 11, which is ¼ and ⅓ of 12, is also ¾ of 14.667, according to the *demand* propounded.

Examples of the rule of double Position.

4 A B and C are to *divide* 237,l.5.s.8,d. amongst them, in such sort that B may have 5,l.8,s 9,d. more then A, and C 7,l.3,s.8.d. more then B, the *question* is what *part* each of these parties ought to have of the *summe propounded?* Here I suppose

poſe for my *firſt Poſition*, that A is to have 80,l. and then B muſt receive for his *part* 85, l.8,s.9,d. and C,92,l.12,s. 5,d. becauſe B is to have 5,l.8,s.9,d. *more* then A, aud C,7,l.3,s.8,d. more then B, as aforeſaid: Now the *totall* of 80,l.+ 85,l.8,s.9,d. + 92,l. 12,s. 5,d. is 258,l. 1,s.2,d. which ought to haue been 237,l. 5,s.8,d. if I had gueſſed *right*; wherefore deducting 237,l.5,s.8,d. out of 258,l.1,s, 2,d. the *remainder* is 20,l.15,s.6,d. which being an exceſſe, I reſerve, as the *firſt errour*: Again, for the *ſecond Poſition*, I gueſſe that A, ought to have 78,l. and then B, is to have for his *part*, 83,l.8,s. 9,d. And C,90,l.12,s.5,d. Now the ſum of 78,l.+ 83,l.8,s.9,d. + 90,l.12,s.5,d. is 252,l.1,s.2,d. wherefore I perceive that I have miſſed the *mark* this time alſo by the *exceſſe* or overplus of 14,l.15,s,6,d. which I retein, as the *errour* of my *laſt Poſition*; Having thus invented *two Poſitions*, and diſcovered their *Errours*, I proceed according to the *directions* delivered in the 1 *Example* of the 6 rule of the laſt Chapter of the 1 Book; which done, I finde that the *part* belonging to A, is 73,l.1,s.6,d.

The

The first Position	80.	1.90309
The last Errour	14.775	1.16953
The first Product	1182.	3.07262
The second Position	78.	1,89210
The first Errour	20.755	1.31753
The last Product	1620.4	3.20963
The diff. of the Prod.	438.4	2.64188
The diff. of the Errour	6.	0.77815
The part belonging to A viz. 73,l.1,s.6,d.	73.07	1.86373

Now unto 73,l.1,s.6,d. if you *adde* 5,l.8,s.9,d. the sum is 78,l.10,s.3,d. which is the *part* which B ought to have, and lastly, if unto 78,l.10,s.3,d. you *add* 7,l.3,s.8,d. the *sum* is 85,l.13,s.11,d. which is the *part* that appertains to *C*: For these three sums, *viz.* 73,l.1,s.6,d. + 78,l.10s.3,d. + 85,l.13,s.11,d. being *added* together, amount to 237,l.5,s.8,d. which was the

the *ſumme propounded* to be divided betwixt the *parties*, as aforeſaid.

5 A *Gentlemans Bailiffe* having received into his Maſters *Granary*, a certaine quantity of *Corn*, whereof part was *Wheat* and the reſt *Barley*, by reaſon of other urgent occaſions omitted for the preſent to *enter* in his *Book* the *ſeverall* quantities of the *Wheat* and *Barley*; afterwards he comming into the *Granary*, began to bethink with himſelf how much *Wheat*, and how much *Barley* he had there, but not being able to call that to minde, he asked the *labourers*, that threſht it out, *how much* there was of *each*? who *anſwered*, that they had forgot, but this they remembred wel, that there was in all of *Wheat* and *Barley* together 108, *qu.* 2 *buſhels*, and that they received for their *labour* 4, l. 19, s. 3, d. at the *rate* of 1, s. 1, d. 2, f. the *Quarter* of *Wheat*, and of 8, d 3, f. the *Quarter* of *Barley*: Now the *queſtion* was, how much *Wheat* and how much *Barley* the *Bailiffe* had laid in the *Granary*: Here firſt I *ſuppoſe* that there was 30 *Quarters* of *Wheat*, and therefore 78 *Quarters*, 2 *buſhels* of *Barley*; Now 30 *Quarters* of *Wheat* at 1, s. 1, d. 2, f. the *Quarter*, amount to 1. 6875, l. and the 78, *qu.* 2. *bu.* of *Barley* at 8, d. 3, f. the

the *quarter* come to 2.8528,l. theſe *ſums* added together make 4.5403,l. which comes .4222 ſhort of 4.9625, the *ſumme*, that it ſhould be; wherefore reſerving .4222 for my *firſt Errour*, I gueſſe the *ſecond* time, that there was 40 *Quarters* of *Wheate*, and conſequently 68 *Quarters*, 2 *buſhels* of *Barley*: And then the 40 *quarters* of *wheate* at 1,s.1,d.2.f. the *quarter*, comes to 2.25,l. likewiſe the 68,*qu.* 2,*bu.* of *Barley* at 8,d.3,f. the *quarter* amounteth to 2.4881,l. Now theſe *two ſums* being added together, make 4.7381,l. which yet wants of the *ſumme* it ought to be .2244,l. which is the *Errour* of my *ſecond Poſition*. Being thus furniſhed with *two Poſitions*, and *two Errours*, I proceed according to the *directions* given in the 2 *Example* of the 6 *rule* of the laſt *Chapter* of the 1 *Booke*, and finde the *quantity* of *Wheat* laid up in the *Granary* to be 51.34,*qu.* which being reduced is 51,*qu.* 2,*bu.* 3,*pe.* In like manner the *Barley* to be 56.91,*qu.* which likewiſe after reduction is 56,*qu.* 7,*bu.* 1, *peck*,

The

The first Position	30.	1.47711
The last Errour	.2244	—0.64896
The first Product	6.733.	0.82815

The second Position	40.	1.60206
The first Errour	.4222	—0.37447
The last Product	16.889	1.22759

The Diff. of the Pr.	10.156	1.00672
The Diff. of the Err.	.1978	—0.70376
The quantity of Wheat	51.34	1.71048
	108.25	
The quantity of Barley	56.91	

The Proof.

1. *Quarter of Wheat*	1.	0.00000
1,s.1,d.2,f.	.05625	—1.24990
51.34, *Quart.*	51.34	1.71048
The wag. disb. for the Wh.	2.888	0.46058

1 *Quarter*	1.	0.00000
8,d.3,f.	.036458	8.43822
56.91 *Quarters*	56.91	1.75513
the wag. disb. for the bar.	2.0745	0.31691
	2.888	
The ſumme of the wag.	4.9625	
viz. 4,l.19,s.3,d.		

But a briefer way to *prove* this *Example*, is to adde the *ſeverall quantities* of the *Wheat* and *Barley* together; So 51.34 + 56.91 make 108.25, which after reduction is 108,*qu.* 2,*bu. viz.* the *totall quantity* of the *Wheat* and *Barley* at firſt propounded.

6 There is a ſtately *Fountain* in which is placed a *Maremaid*, from which iſſues three *Chriſtall* ſtreams, *viz.* one from her *left teat*, another from her *right*, and the third out of her *mouth*: Theſe *ſtreams* are ſo ordered that they all deſcend into a coſtly *Ciſtern* of *Marble*: Now the *Conduits*, through which theſe *ſtreams* paſſe, are contrived to be of differing *capacities*, In ſuch ſort, that the *left teat*, being ſet open alone, and the other two ſtopt, the *Ciſtern* will be full in 48 *houres*: again, the

the *right teat* onely being opened, the *ſtream*, that iſſues from thence, will fill it in 36 *houres*, but the *two teats* being ſtopt and the *mouth* ſet open, the *Ciſterne* will be full in 12 *houres*: Now the *queſtion* is, in what time the *Ciſterne* will be filled in caſe you ſet open *all theſe ſtreams* at once? For anſwer to this demand, firſt, I ſuppoſe that the *Ciſterne* will be full in 10 *hours*, and then to diſcover, whether in taking this *Poſition* I have hit the marke, I make uſe of theſe *Proportions* following.

I. If in 48 *houres* the *ſtream* iſſuing out of the *left teat* fils 1, *viz.* the whole *Ciſtern* in 10 *houres*; how much of the ſame *Ciſtern* will be filled by the ſame *ſtream*? *Facit*, .20833 of the *Ciſtern*.

II. If in 36 *houres*, the *ſtream* running out of the *right teat* fils 1, *viz.* the intire *Ciſtern* in 10 *houres*; how much of the ſame *Ciſtern* will be filled by the ſame *ſtream*? *Facit* .27777 of the *Ciſtern*.

III. If in 12 *houres* the *ſtream* guſhing out of the *mouth* fils 1, *viz.* the whole *Ciſtern*: In 10 *houres*, how much of the ſame *Ciſtern* will be filled by the ſame *ſtream*? *Facit*, .8333 of the *Ciſtern*.

Now theſe *three parts* of the *Ciſtern*, *viz.* .20833 + .27777 + 8333 being all *added* together make 1.31940, by which ſumme I perceive, that if all the *ſtreams* be let looſe *at once* during the ſpace of 10 *houres*, they will run the *Ciſtern* full, and beſides .3194 of the *Ciſtern* over: So that you ſee by this *firſt Poſition*, I have *over-ſhot* the mark .3194 *Ciſtern*, which I reſerve for my *firſt Errour*. Wherefore I make conjecture the *ſecond time*, that in the ſpace of 4 *houres* the *Ciſtern* will be filled: And then the *Proportions* of this *ſuppoſition* are as followeth.

I. If in 48 *houres* 1 *Ciſtern*, how much in 4 *houres*? *Facit* .08333 *Ciſt.*

II. If in 36 *houres* 1, how much in 4? *Facit* .11111

III. If in 12 *houres* 1, how much in 4? *Facit* .33333.

Now

Now theſe three parts of the *Ciſtern*, *viz.* .08333 + .11111 + .33333 being all added into one ſumme produce .52777, intimating, that *all theſe ſtreams* being let go during the ſpace of 4 *houres*, they will but fill .52777, of the *Ciſtern* in that time, which wants .47223 of the *intire Ciſtern*, for if you deduct .52777 out of 1, or 1.00000 the *remainder* is .47223: Being thus provided of two *Poſitions*, and as many *Errours*, I proceed according to the laſt *Example* of the 6 *rule* of the laſt *Chapter* of the 1 *Book*, and finde that *all thoſe three ſtreams* being let go together, the *Ciſtern* will be full in 7.578 *houres*; which being reduced by the *Rule of three Direct* into *houres* and *minutes*, are 7, *houres* 34 $\frac{614}{1000}$ *minutes*.

See the fifth rule of the 3 chapter of the 1 Book.

48.	1.68126
1:	0.00000
10.	1.00000
	1.00000
.20833	—0.68126
	31874

36.	1.55633
1.	0.00000
10.	1.00000
	1.00000
.27777	—0.55633
	44367

12.	1.07918
1.	0.00000
10.	1.00000
	1.00000
.8333	—0.07918
1.31940	92082

.3194, *The* 1 *Errour* too much.

48.	1.68126
1.	0.00000
4.	0.60206
	0.60206
.08333	—1.07920
	92080

36.	1.55633
1.	0.00000
4.	0.60206
	0.60206
.11111	—0.95427
	04573

12.	1.07918
1.	0.00000
4.	0.60206
	0.60206
.33333	—0.47712
.52777	52288
1.00000	

.47223, *The* 2, *Error* too little

The first Position	10.	1.00000
The last Error	.47227	—0.32587
The first Product	4.7223	0.67413

The

The ſecond Poſition	4.	0.60206
The firſt Errour	.3194	—0.49567
The laſt Prduct	1.2777	0.10639

The ſumme of the pr.	6.	0.60206
The ſumme of the Err.	.79136	—0.10148
The time of filling the Ciſtern, viz. 7, Ho. 34 $\frac{684}{1000}$ min.	7.578	0.87962

Vide l. 1. chap. 11. rule 1. For as 1000 to 60, the number of *minutes* in an *houre*; So is 578 to 34.684 *minutes*.

The Proof.

48.	1.68126
1.	0.00000
7.578	0.87963
.15788	—0.80163
	19837

36.	1.55623
7.578	0.87963
.21052	—0.67670
	32330

12.	1.07918
7.578	0.87963
.6316	—0.19955
.21052	80045
.15788	
1.00000	

Here you may *observe*, that these *three parts* of the *Cistern, viz.* .6316 + .21052 + .15788 make 1 0.000, which is 1, *that is*, neither more nor lesse the *one Cistern* full; whereupon I boldly *conclude*, that the whole *operation* is exactly performed.

And thus have we (as you see) performed the chiefest operations of *naturall Arithmetique* by help of the *Logarithmes*: with how much more *ease* and lesse *confusion*, then by the ordinary way of *Naturall Arithmetick*, I leave to be determin'd by the *judgement* of those that understand *both*:

How-

Howbeit there are divers other *operations* feasible by the *Logarithmes*, *viz.* these that follow, and the like.

1 *To create a ranke of numbers Geometrically proportionall.*

2 *In a rank of numbers Geometrically Proportionall to finde out any terme required.*

3 *To finde out as many mean Proportionals betwixt any two numbers given as shall be required.*

4 *To finde out as many continuall means betwixt any two numbers given, as shall be required.*

5 *To summe a rank of numbers Arithmetically Proportionall.*

6 *To summe a rank of numbers Geometrically proportionall, &c.*

But *all these* and *divers others*, which for the most part serve rather for *curiosity* then *use*, we have voluntarily omitted, presuming that the *Ingenious Practitioner* (after he *rightly* understands the nature of *Logarithmes*) will be able to resolve all these *Propositions*, and the like, without any farther *Instruction*.

The

The Appendix.

Chap. I.

Equation of Time, according to the ordinary way.

I. *Equation of Time is that by which having ſeverall ſummes payable at ſeverall dayes, we diſcover the mean time, when thoſe ſummes may be paid together (at one entire payment) without loſs either to the Debtor, or Creditor.*

Example, A ſtands *ingaged* to B the 1 *day* of *January* 1629, in the ſumme of 2357,l. to be paid at *three* ſeverall payments, *viz.* 1200,l. upon the 3 *day* of *May* next comming, which is 4, *mo.* and 3 *dayes* after his *Ingagement*; Again, the 11 of *November*, in the year, 1630. (*viz.*

10,

10 *moneths*, 11 *dayes* after the agreement made) 835 l. And the reſt (*viz.* 322. l.) upon the 25 *day of March*, 1631, which is 1 *year*, 2 *mo* 25 *da.* after A ſtood *charged* with the *debt:* Now the *parties* being agreed, that the *debt* ſhall be diſcharged at *one intire* payment, this rule of *Equation* will diſcover the *mean time*, when A ought to make *payment* thereof without loſſe to either *party*.

II. *To finde the mean time of ſeverall payments, proceed thus; Having changed the ſummes propounded to Fractions* (viz. *by appointing the totall ſumme for the common Denominator, and the particular ſummes for Numerators*) *multiply each Fraction by his reſpective time; this done, the ſumme of the ſeverall Products is the mean time you look for.*

1 So in the premiſed *example* 2357. l. being the *totall*, and 1200, l. 835, l. and 322, l. the *particular ſummes*, the *fractions* produced of them, according to this preſent *Rule*, will order themſelves in this manner.

$\frac{1200}{2357}$ $\frac{835}{2357}$ $\frac{322}{2357}$

Now

Now therefore if I multiply $\frac{1200}{2357}$ by 4 *mo.* 3 *da.* (the time appointed for the payment of the 1200,l.) the *product* is .17389: Again, the *product* of $\frac{835}{2357}$ multiplied by 10, *mo.* 11, *da* is .3059: And the product of $\frac{322}{2357}$ multiplied by 1 *year*, 2 *moneths*, 25 *dayes*, is .16874. Lastly, the *summe* of these three *Products* is .64853, which being reduced by the *Tablet* of *time* into *moneths* and *dayes*, is 7 *moneths*, 24 *dayes*. I conclude therefore, that 7 *moneths* 24 *dayes* after the first of *Ianuary* 1629 (*viz.* upon the 24 *day* of *Auguſt* 1630) the 2257,l. wherewith A ſtands *charged*, ought to be payed to B at one *entire payment*; for that is the *mean time* required, and the reſolution of the *queſtion* propounded. See the work:

$\frac{1200}{2357}$ { 1200 — 3.07918
{ 2357, — 3.37236

— 0.29318

4, *m.* 3, *d.* .34155 — 0.46655

.17389 — 0.75973

24027

Vide ſupra l.2 c.6 rule 2. Item l.2.c 7. r.4. examp.4.

$\frac{835}{2357}$

10 *moneths*, 11 *dayes* after the agreement made) 835 l. And the reſt (*viz.* 322. l.) upon the 25 *day of March*, 1631, which is 1 *year*, 2 *mo.* 25 *da.* after A ſtood *charged* with the *debt:* Now the *parties* being agreed, that the *debt* ſhall be diſcharged at *one intire* payment, this rule of *Equation* will diſcover the *mean time*, when A ought to make *payment* thereof without loſſe to either *party*.

II. *To finde the mean time of ſeverall payments, proceed thus; Having changed the ſummes propounded to Fractions* (viz. *by appointing the totall ſumme for the common Denominator, and the particular ſummes for Numerators*) *multiply each Fraction by his reſpective time; this done, the ſumme of the ſeverall Products is the mean time you look for.*

1 So in the premiſed *example* 2357. l. being the *totall*, and 1200, l. 835, l. and 322, l. the *particular ſummes*, the *fractions* produced of them, according to this preſent *Rule*, will order themſelves in this manner.

$\frac{1200}{2357}$ $\frac{835}{2357}$ $\frac{322}{2357}$

Now

Now therefore if I multiply $\frac{1200}{2357}$ by 4 *mo.* 3 *da.* (the time appointed for the payment of the 1200 l.) the *product* is .17389: Again, the *product* of $\frac{835}{2357}$ multiplied by 10 *mo.* 11 *da* is .3059: And the product of $\frac{322}{2357}$ multiplied by 1 *year*, 2 *moneths*, 25 *dayes*, is .16874. Lastly, the *summe* of these three *Products* is .64853, which being reduced by the *Tablet* of *time* into *moneths* and *dayes*, is 7 *moneths*, 24 *dayes*. I conclude therefore, that 7 *moneths* 24 *dayes* after the first of *Ianuary* 1629 (*viz.* upon the 24 *day* of *Auguſt* 1630) the 2357 l. wherewith A ſtands *charged*, ought to be payed to B at one *entire payment*; for that is the *mean time* required, and the reſolution of the *queſtion* propounded. See the work:

Vide ſupra l. 2 c. 6 rule 2. Item l. 2. c 7. r. 4. examp. 4.

$\frac{1200}{2357}$ { 1200 — 3.07918
{ 2357, — 3.37236

— 0.29318

4, *m.* 3, *d.* .34155 — 0.46655

.17389 — 0.75973

24027

$\frac{835}{2357}$

$\frac{835}{2357}$ 2.92169
3.37236

—0.45067
10,m.11,d. .86347 —0.06375

.3059 —0.51442
48558

Item, ibid. rule 5.

$\frac{322}{2357}$ 2.56785
3.37236

—0.86453
1,ye.2,m.25,d. 1.23516 0.09172

.16874 —0.77278
.3059
.17389

7,m.24.d. .64853
58333

06520

---

2 A is *indebted* to B upon the 24 of *June*, 1630, in the ſumme of 537,l.11,s. 4 d. to be paid at *three* ſeverall payments, *viz.* 372,l.7,s.10,d. upon the 2 of *Februa-*

ry

ry next ensuing (*viz.* 7, *mo.* 8 *da.* after the Ingagement:) Again, 115, l. 16, s. 8, d. upon the *first* of *May*, 1631, being 10 *mo.* 6 *dayes* after A stood engaged: and the rest (*viz.* 49, l. 6, s, 10, d.) upon the 11 of *November*, 1631, being 1 *year*, 4, *mo.* 17, *dayes* after A stood *charged* with the *debt*.

Here having reduced the *broken parts* of the summes propounded to *Decimals*, proceed as in the former *example*. This done, you shall finde the *mean* day of payment to be 8 *moneths*, 23 *dayes* after the ingagement, *viz.* the 17 *day* of *March*, 1630.

537, l. 11, s. 4, d.	537.566
372, l. 7, s. 10, d.	372.391
115, l. 16, s, 8, d.	115.833
49, l, 6, s. 10, d.	49.3416

$\frac{372.391}{537.566}$	372.391	2.57100
	537.566	2.72897
		—0.15797
7, *m.* 8, *d.*	.60525	—0.21803
	.42072	—0.37600
		62400

$\frac{115.833}{537.566}$

115.833 / 537.566	115.833 537.566	2.06382 2.72897
		—0.66515
10,*mo*.6,*da*.	.84977	—0.07070
	.18372	—0.73585 26415

49.3416 / 537.566	49.3416 537.566	1.69321 2.72897
		—1.03576
1,*ye*.4,*m*.17,*d*.	1.3799	0.13985
8,*m* 23,*da*.	.12708	—0.89591
	.18372	10409
	.42072	
	.73152	
	66666	
	06486	

CHAP.

CHAP. 2.

Intereſt of money.

I. *WHen a ſumme is forborn a certain time, to finde how much it will be augmented at the expiration of the ſame time, accounting Intereſt upon Intereſt according to a certain rate propounded, this is the Rule: Deduct the Logarithme of* 100 *from the Logarithme of* 100, *and the rate added together; this done, if you multiply their difference with the time propounded, and then adde that product unto the Logarithme of the ſtock, or principall; that ſum is the Logarithme of the ſtock, and intereſt required.*

Vide Briggii Arith. Logarith. cap. 17. *Prop.* 1.

Example, How much ought *A* to receive of *B* for 137, l 9, s. 10, d. being forborn 5 *yeares*, 7 *moneths*, and 15 *dayes*, accounting *Intereſt upon Intereſt* at the *rate* of 8, l. *per*, 100, l. for the *year*? Here if I *ſubtract* 2.00000, the Logarithme of 100 out of 2.03342, the Logarith. of 108, the *remainder* is 3342, which being multiplied by

by 5 *years*, 7 *moneths*, 15 *dayes*, produceth 18797: Now therefore if I *adde* the ſame 18797 to 2.13827, the Logarithme of 137,l.9,s.10.d. the ſumme thereof is 2.32624, which is the Logarithm of 211,l. 19,s. the *ſum* due to *A* at the expiration of the 5 *years*, 7 *moneths*, 15 *dayes*, in conſideration of the 137,l.9,s.10,d. *lent* to B for that time, accounting *Intereſt upon Intereſt*, at the *rate* of 8,l. *per centum*.

100,l.	100.	2,00000
100,l. *and the rate*	108.	2.03342
The Difference		3342
The Difference	3342.	3.52401
5,*ye*.7,*m*.15.*d*.	5.6244	0,75008
The Product	18797	4.27409
137,l.9,s.10,d.	137.491	2.13827
The Product		18797
211 ,l.19.s.	211.95	2.32624

Vide Brigg. ibidem.

II. *When a ſumme is due at a time to come, to finde what it is worth in ready money; Proceed as in the former rule, onely at laſt in ſtead of adding, deduct the product out of the Logarithme of the principall; for this*

this done, the remainder is the Logarithme of the ſum required.

Example, A being *ingaged* to *B* in the *ſum* of 137,l. 9,s. 10,d. to be paid at the expiration of 5 *years*, 7 *moneths*, 15 *dayes*, is deſirous to redeem that ſum with *ready money*, upon condition that *B* ſhall *defalke* the intereſt for that time, according to the *rate* of 8 *per centum*: The *demand* is, how much *A* ought to pay in *ready money*? *Facit*, 89,l. 3,s. 8,d.

137,l. 9,s. 10,d.	137.491	2.13827
		18797
89,l, 3,s. 8,d.	89.18	1.95030

III. *The principall, together with the Intereſt for a certain time being propounded, to finde the rate of the Intereſt, purſue this direction following: Deduct the Logarithm of the principall out of the Logar. of the principall and Intereſt added together: this done, if you divide their difference by the time, and laſtly, adde that Quotient to the Logarithme of* 100,l. *that ſum is the Logarithme of* 100,l. *and the Rate added together.* *Vide Brigg. ibid. prop. 2.*

A having a *Daughter* of the Age of 3 *ye.* delivers to *B* at the same time a thousand *Marks*, or 666,l. 13,s. 4,d. upon condition that *B* shall re-deliver unto his *daughter* at the Age of 15 *years* two thousand *Markes*, or (which is all one) 1333,l. 6,s. 8,d. Now the *Question* is, at what *rate B* enjoyes the 666,l. 13,s. 4.d. that it may augment to 1333,l. 6,s. 8,d. in 12 *yeares? Facit*, at the *rate* of 5,l. 19,s. *per centum*. For here first I deduct 2.82390, the Logarithme of 666,l. 13,s. 4,d, out of 3.12493 the Logarithme of 1333,l. 6,s. 8,d. this done, their *difference* is 30103, which if I divide by 12, the *quotient* is 2508.6, this *quotient* if I adde to 2.00000, the Logarithme of 100, the *summe* is 2.02509, which is the Logarith. of 105,l, 19,s. I conclude therefore, that the 666,l. 13,s. 4,d. will increase in 12 *yeares* to 1333,l. 6,s. 8,d. at the rate of 5,l. 19,s. *per centum*, which is the *Facit*, or resolution of the *question* propounded, as aforesaid.

1333.6.8.

1333. 6.8.	1333.33	3.12493
666.13.4.	666.66	2.82390
The difference		30103
The difference	30103.	4.47861
12 *yeares*	12.	1.07918
The Quotient	2508.6	3.39943
100,l.	100.	2.00000
The Quotient		2508.6
100,l. *and rate for* 1 *yeare*	105.95	2.02509

CHAP. 3.

Valuation of Leaſes and Annuities.

I. *WHen a yearely Rent or Annuity is forborne a certain number of years, to find what it will then amount unto, according to any rate propounded, this is the Rule, firſt, diſcover the principall of that Annuity, then finde unto what ſum that principall will be augmented (according to the given rate) at the end of the term propounded; this done, if you deduct the ſame principall out of that ſum, the remainder is the ſum you look for.* Vide Brigg. ibid prop. 3.

Example, If an *Annuity* of 16,l. 3,s.4,d. be *areare* for 7 *years*, unto what *ſum* will it then *amount*, accounting the particular *Annuities* behinde, ſtill to *augment* after the rate of 6,l. *per centum*? Here firſt, to finde the correſpondent *principall* of this *Annuity*, I uſe this *Proportion* following.

If 6,l. hath for his *Principall* 100,l. what is the *Principall* of 16,l. 3,s. 4,d.? *Facit* 269,l. 8,s, 8,d.

Again, by the 1 *Rule* of the laſt *Chapter*, I finde that the *principall* 269,l.8,s.8,d. being forborne 7 *years*, will amount (after the *rate* of 6 *per centum*) to 405,l. 2,s. 8,d. out of which, if I, laſt of all, deduct 269,l. 8,s. 8,d. the *principall*, the remainder is 135,l. 14,s. *viz.* the *ſumme due* at the end of the 7 *yeares* for the *Annuity* areare, as aforeſaid.

6,l.	6.	0.77816
100,l.	100.	2.00000
16.3.4.	16.166	1.20860
		3.20860
2698.8.	269.43	2,43044

100,l.

100,l.	100.	2.00000
106,l.	106.	2.02531
The Difference		2531
The Difference	2531.	3.40329
7 *yeares*	7.	0.84510
The Product	17717.	4.24839
The Principall	269.43	2.43044
The Product		17717
Princ. and Inter.	405.13	2.60761
The Arearages	135.70	

II. *When a rent, or Annuity is propounded, to finde what it is worth in ready money, proceed as in the former rule, and when that work is finished, subtract the product out of the Logarithm of the Arearages; for, this done, the remainder is the Logar. of the price, or value required.* So the *Example* of the last *Rule* being propounded, the *value* of that *Annuity* is 90,l. 4,s. 10,d. for 17717 the *Product*, being deducted out of 2.13257 the Logarithm of 135.70 the *Arearages*, the *Remainder* is 1.95540, which is the correspondent Logarithme of 90,l. 4,s. 10,d. the *value required*, I conclude therefore *Vide Brigg. ibidem.*

that a man willing to beſtow his money after the rate of 6,l. *per centum*, may afford to give for a 7 *years* Leaſe, or *Annuity* of 16,l. 3,s. 4,d. *per annum*, 90,l. 4,s. 10,d.

The Arearages	135.70	2.13257
The Product		17717
90. 4. 10.	90.24	1.95540

Brigg. ibid. III. *Here, when the terme of the Annuity begins not preſently, but after certain years to come, having multiplied the whole diſtance of time by the difference, you are to deduct that Product out of the Logarithme of the Arearages, as before; for, this done, the remainder is the Logar. of the value required.*

Example, I ſuppoſe the ſaid *Annuity* of 16,l. 3,s. 4,d. to begin at the expiration of 4 *yeares*, 2 *moneths*, and 9 *dayes*, and therefore in this caſe I multiply 2531, the *difference* by 11 *years*, 2 *moneths*, 9 *dayes*, & finde the *Product* thereof to be 28325, which if I *ſubtract* out of 2.13257, the Logarithm of the *Arearages*, the *remainder* is 1.84932, which is the Logarithm of 70,l. 13,s. 8,d. the *value required*: For ſo much (inready money, after the rate of 6,l *per centum*) is the worth of a *Leaſe*

or

or *Annuity* of 16,l. 3,s. 4 d. *per annum*, that after the expiration of 4 *yea.* 2 *moneth.* 9 *dayes*, is to continue 7 *compleat years.*

The difference	2531.	3.40329
11. 2, 9.	11.1913	1.04887
The Product	28325.	4.45216

The Arearages	135.7	2.13257
The Product		28325
70. 13. 8.	70.68	1.84932

IV. *A sum of money being propounded, to finde what Annuity (to continue any number of years, and according to any given rate) that summe will buy; this is the* Rule. *Presuppose any Annuity at pleasure; then finde the value of that Annuity in ready money: this done, the Proportion will be as followeth.* *Vide Brigg. ibid. prop. 4.*

As the value found, is to the supposed Annuity: so is the sum given, to the Annuity required.

Example, What *Annuity* (to begin presently, and so to continue 21 *yeares*) will 1275,l. deserve; so that the purchaser may

may *gain* after the *rate* of 8 *per centum*? Here first, I propound, for my *ſuppoſititiall Annuity*, 12,l. *per annum* to continue 21 *years*, whoſe *value* in ready money I finde (by the 2 *Rule* of this *chapter*) to be 120,l. 3,s. 10,d. whereupon I demand, if 120,l. 3,s. 10,d. purchaſe 12,l. *per annum*, what will 1275,l. purchaſe? *Facit* 127,l. 6,s. I conclude therefore, that the purchaſer in *lieu* of his 1275,l. ought to have an *Annuity* of 127,l. 6,s to continue 21 *years*, to the end he may *gain* after the *rate* of 8 *per centum*; which is the reſolution of the *queſtion* propounded.

8,l.	8.	2.90309
100,l.	100.	2.00000
12,l.	12.	1.07919
		3.07919
150,l.	150.	2.17610

100,l.

100,l.	100.	2.00000
108,l.	108.	2.03342
The difference		3342
The difference	3342.	3.52401
21 *yeares*	21.	1.32222
The Product	70180.	4.84623
The Principall	150.	2.17610
The Product		70180
Princ. & Intereſt	754.9	2.87790
The Arear.	604.9	2.78168
The Product		70180
The value found	120.19	2.07988

Value found	120.19	2.07988
Annuity ſupp.	12.	1.07919
Sum given	1275.	3.10551
		4.18470
Annuity requ.	127.3	2.10482

But

Vide Brigg. ibidem.

But here, when the *Annuity* is not to begin *immediately*, finde the *value* of the *Suppositiall Annuity* by the 3 *rule* of this *Chapter*, and then proceeding as in the premised *Example*, you may likewise easily discover the *Annuity* you look for. So 1275, l. being again propounded, I demand, what *Annuity* (to continue 21 *years*, but not to begin untill the expiration of 4 *years*, 2 *moneths*, 9 *dayes*) may the same *sum* deserve, that the purchaser may gain 8 *per centum*? *Facit* 175, l. 15, s. 3, d.

The difference	3342.	3.52401
25, *years* 2, *m.* 9, *da.*	25.191	1.40125
The Product	84190.	4.92526
The Arear.	604.9	2.78168
The Product		84190
Value found	87.05	1.93978

Value found

Value found	87 05	1.93978
Annuity supp.	12.	1.07919
Summe given	1275.	3.10561
		4.18470
Annuity required	175.76	2.24492

FINIS.

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